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HISTORY of WAR

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A CENTURY OF ELITE FRONTLINE ASSASSINS

CROMWELL'S REBEL ARMY

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- Yom Kippur War
- Panavia Tornado

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BATTLE OF THE ATLANTIC

Explore the technology and tactics that crushed the Nazi U-boat menace

BLOODY REVENGE AT ROCROI
SPAIN'S ELITE INFANTRY FACE A FINAL SLAUGHTER

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BIRTH OF THE BATTLE TANK
INSIDE THE WORLD'S MECHANISED MONSTERS

World War I

The German Field Kitchen

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Welcome

"I had rather a plain russet-coated captain that knows what he fights for and loves what he knows, than that which you call a gentlemen, and is nothing else"

– Oliver Cromwell, lord protector of England

In a fight, gaining the edge on your opponent in any way possible often makes the difference between victory and defeat. Historically this has prompted the development of new technologies, from humble swords of the ancient world to the modern fighting machines of the 20th century.

In the Battle of the Atlantic, new wartime tech was rapidly produced to re-gain the edge on Nazi Germany, whose U-boats threatened the very survival of the free world.

In the British Civil Wars, Oliver Cromwell didn't find victory in a new deadly invention, but in the character and discipline of his men. His 'New Model' gave England its first standing army, and a definite edge that would last for centuries.

Tim Williamson
Editor

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frontline@imagine-publishing.co.uk

CONTRIBUTORS

TOM GARNER
History of War's newest recruit has escaped his former life as a Tudor day labourer and leapt forward a century to bring us thrilling accounts of the Battle of Rocroi (page 46), as well as the rise and fall of England's New Model Army (page 74).

NICK SOLDINGER
Nick's back for another year plunging the murky depths of military history for your enjoyment. In 2016's first cover feature he investigates the incredible technology and tactics that blew the Third Reich's submarines out of the water (page 26).

LEIGH NEVILLE
This issue Leigh has re-watched *American Sniper* in preparation for his feature running down history's ten deadliest sharpshooters, from the crack shots in the trenches of WWI to the intrepid jungle hunters of the Vietnam War (page 34).

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Read about how vital shipping convoys were protected from Nazi U-boats on page 26

SUB HUNTERS

Frontline

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GREAT BATTLES: ROCROI

10 DEADLIEST SNIPERS

34 Who were history's most devastating battlefield hunters?

56 The cutting-edge methods behind the deadliest swords

74 How did parliament's New Model crush the crown?

WAR in FOCUS

STAY COOL UNDER FIRE

Taken: ***February 2006***

A British Royal Marine Commando and member of the Brigade Patrol Troop (BPT) takes part in a live firing exercise in Norway. The BPT is a reconnaissance unit, and is usually deployed ahead of the main brigade of Royal Marines. As part of their training, members of the BPT take part in mountain and Arctic warfare exercises, and are also parachute trained.

WAR in FOCUS

‘TANKS TAKE OFF!’

Taken: ***c. 1953***

A Cromwell tank takes to the air during a point-to-point and obstacle course demonstration at Bovington Camp in Dorset. Thousands of spectators turned up to watch the spectacle of the racing tanks, and Pathé News covered the event with a report accurately titled ‘Tanks Take Off!’. The inspired comment, “That was 28 tons of solid Cromwell Tank,” followed the tank’s incredible high-speed leap.

WAR in FOCUS

THE PASSAGE OF THE DEVIL'S BRIDGE...

Painted: ***1799***

Here Johann Baptist Seele depicts the precarious fight between a Russian vanguard, under command of the famed general Alexander Suvorov, and a French Republican rearguard during the War of the Second Coalition. Retreating before Suvorov's army, the French had already destroyed the vital bridge in an attempt to stall the Russians – cutting off the critical link between northern and southern Switzerland.

WAR in FOCUS

GUARDED NEUTRALITY

Taken: ***c. 1914-18***

Three Swiss mountain patrol officers overlook the Surettahorn mountain in the Swiss Alps, bordering northern Italy. In its status of armed neutrality during WWI, Switzerland mobilised several thousand troops along its mainly mountainous borders, predominantly along its western borders with France, which at the time was perceived as the greatest threat.

MAIN BATTLE TANKS

From the tracked triumphs that rumbled across battlefields in the wake of WWII, to the sophisticated modern-day armoured monsters, the MBT dominated most of the 20th century's major war zones

***Above:** The Centurion saw combat in the front lines into the 1980s*

CENTURION TANK

THE FIRST MAIN BATTLE TANK, OR UNIVERSAL TANK

First introduced: 1945 Country: Great Britain

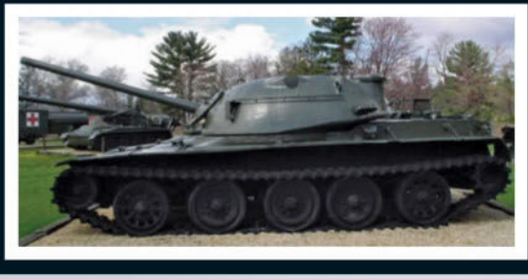
In response to the combat experience of British armoured forces during World War II, particularly against the heavy German Tiger tank, specifications were issued for a new tank incorporating speed, firepower, armour protection, and a modicum of weight. The Centurion was produced in no fewer than a dozen variants, or marks.

COMPOSITE ARMOUR

PROVIDING GREATER PROTECTION AND LIGHTER WEIGHT

First introduced: 1955 Country: United States

Composite armour revolutionised the development of armoured vehicles, particularly the main battle tank. Conceived and applied for the first time with the US Army's T95 experimental tank series, the initial composite armour was noted for its "siliceous core" and included fused silica glass between rolled steel plates for better protection and lighter weight.



***Right:** The experimental T95 medium tank was the first to utilise composite armour*

"WIDELY ACCLAIMED AS BRITAIN'S MOST SUCCESSFUL TANK WEAPON AND ONE OF THE WORLD'S BEST"

The L7 105mm rifled gun has been mounted on the main battle tanks of numerous countries

L7 105MM L/52 GUN

HEAVY WEAPON, WITH A LIGHTER PLATFORM

First introduced: 1956 Country: Great Britain

The main battle tank gained significant traction with the realisation that it was capable of carrying increasingly powerful main weapons. Widely acclaimed as Britain's most successful tank weapon and one of the world's best, the Royal Ordnance L7 105mm L/52 rifled gun was adopted by several countries, including Germany, the United States and Japan.

The British Challenger 2 uses second-generation Chobham armour

CHOBHAM ARMOUR

SUPERIOR COMPOSITE ARMOUR PROTECTION

First introduced: 1960s Country: Great Britain

By the mid-1960s, British scientists at Chobham Common developed a new generation of composite armour, and its actual composition remains classified. Chobham armour incorporates ceramic, well known for its hardness, and other components. Since its introduction, Chobham has been used in the main battle tanks of many countries and set a standard in the armaments industry.

L/44 120MM SMOOTHBORE GUN

COMPETING WITH THE WARSAW PACT

First introduced: 1979 Country: Germany

In response to the development of Soviet-bloc anti-tank armour and emerging weapons platforms, Rheinmetall-DeTec AG in West Germany began developing a more powerful weapon for the Leopard 2 main battle tank. The smoothbore barrel was lined with chrome for extended service life. The L/44 was adopted by the US Army, and later an improved version, the L/55, was introduced.

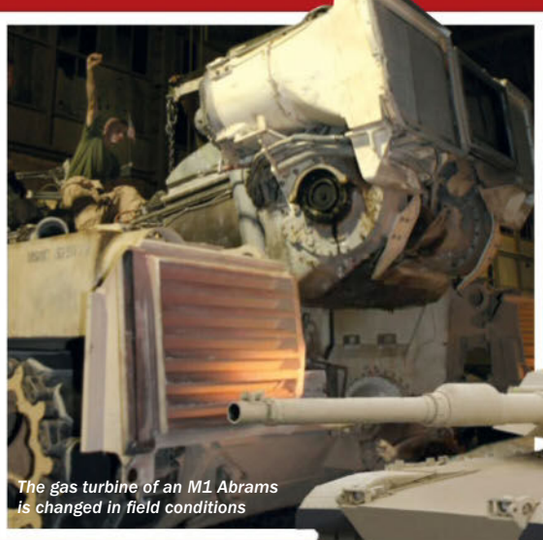
The barrel of the L/55 weighs 1,190kg

HONEYWELL AGT1500 MULTI-FUEL TURBINE ENGINE

A QUIET, RELIABLE AND LIGHTWEIGHT POWERPLANT

First Introduced: 1970s Country: United States

Gas turbine engines, both in the East and West, date prior to World War II. Introduction of the gas and later multi-fuel turbine engine in tanks continued during the Cold War. The T-80 was the first Soviet operational tank powered solely by a turbine engine. The US M1 Abrams series is powered by the Honeywell AGT1500, generating 1,500 horsepower.



The gas turbine of an M1 Abrams is changed in field conditions

URBAN WARFARE MODIFICATIONS

THE DYNAMICS OF MODERN COMBAT IN URBAN SETTINGS PROMPTED CHANGE

Founded: 1983 Country: Israel

Following the 1982 incursion into Lebanon by the Israel Defense Forces, the Merkava main battle tank was modified for greater survivability in urban warfare settings, particularly narrow streets and multi-storey buildings. Chain netting and rear-facing cameras were among the improvements in the Merkava II. The US Abrams series incorporates the TUSK (Tank Urban Survivability Kit) system.

***Below:** An M1 Abrams upgraded with the TUSK system has armour upgrades to the rear and bottom of the hull, among other improvements*

5 Facts about MAIN BATTLE TANKS

IN THE AIR AND ON LAND

For decades, engines that were originally intended to be used with aircraft have been adapted to serve as powerplants for tanks. One example of this is the Honeywell AGT1500, which powers the US M1 Abrams main battle tank series.

SHARED TECHNOLOGY PUSHES THE ENVELOPE

The development of the modern main battle tank has become a collaborative effort as nations such as the United States, Great Britain, Germany, and Japan have shared technology in various systems.

OPTIMISED SPACE UTILISATION

As technology has advanced, numerous main battle tanks have incorporated an autoloader system that reduces the need for a crewman to perform the task of loading the main weapon.

TANK CHASSIS MOUNT VARIOUS EQUIPMENT

The chassis of many main battle tanks are routinely configured or converted to purposes other than direct combat, including command vehicles, armoured ambulances, bridging vehicles, and communication and supply variants.

SKYROCKETING COSTS COMPEL UPGRADES

Although technology continues to advance, the armed forces of many nations have opted to implement longevity or improvement programmes to their main battle tanks rather than invest in completely new combat systems.

ANATOMY OF A CHALLENGER 2

The British Army's Challenger 2 is one of the most sophisticated weapons of its kind

ARMOUR PROTECTION
State-of-the-art Chobham composite armour protects the Challenger 2 main battle tank, and is reportedly stronger than multiple layers of steel. The precise composition of the armour remains classified.

CREW COMPARTMENT
The four-man crew of the Challenger 2 is seated inside the turret and chassis. The commander occupies a position in the turret to the right with the loader to his left. The driver and gunner are seated below in the hull.

L30A1 120MM MAIN WEAPON
Manufactured by BAE Land Systems from electro-slag refined (ESR) steel, the L30A1 120mm rifled gun is equipped with a thermal sleeve, fume extractor and muzzle reference system. Sometimes referred to as the CHARM (Challenger Main Armament) Gun, it is 55 calibres long.

FUME EXTRACTOR

GRENADE LAUNCHERS

THERMAL IMAGING SENSORS

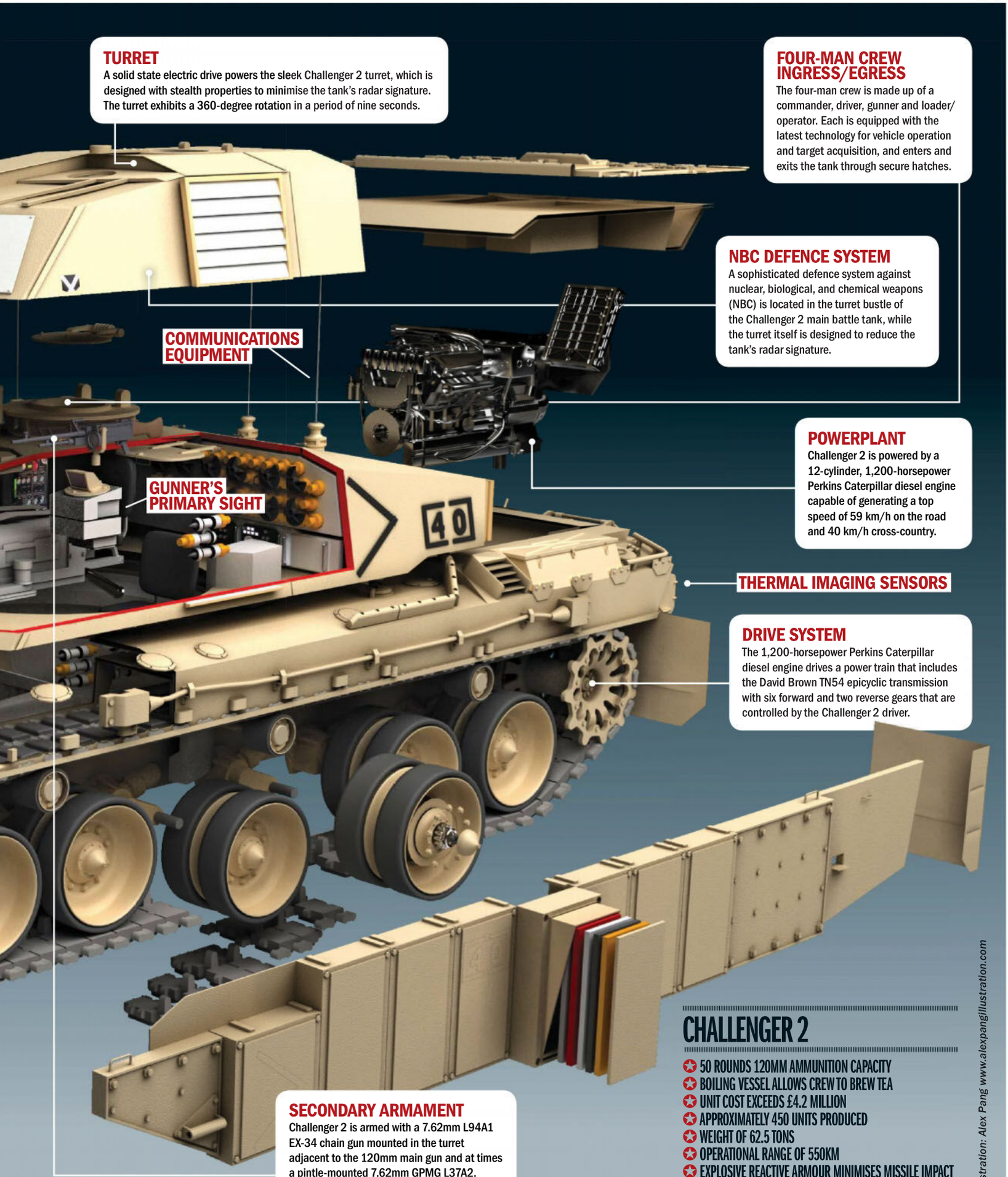
CHALLENGER 2 – THE CUTTING EDGE

This main battle tank entered service with the British Army in 1998 and has seen deployments in Bosnia, Kosovo and Operation Iraqi Freedom. It is also the primary main battle tank of the Royal Army of Oman. Its L30A1 120mm rifled gun is the exception among Western tanks, which usually mount smoothbore weapons. It is capable of firing a variety of ordnance, including HESH (high-explosive squash head) and APFSDS (armour-piercing fin stabilised discarding sabot) rounds. The Challenger 2 has a fine combat record, sustaining damage but withstanding rocket-propelled grenades, anti-tank missiles and IEDs (improvised explosive devices). Its service life is estimated to extend to 2035, and an export variant, the Challenger 2E, has been evaluated in numerous countries.

***Below:** A Challenger 2 aims its L30A1 120mm main gun at a distant target*

STATE-OF-THE-ART SUSPENSION
The Challenger absorbs the rigours of cross-country and road traverse with its second-generation hydropneumatic suspension and hydraulic track tensioner system that support the William Cook Defence hydraulically adjustable double pin tracks.

"THE CHALLENGER 2 HAS A FINE COMBAT RECORD, SUSTAINING DAMAGE BUT WITHSTANDING ROCKET-PROPELLED GRENADES, ANTI-TANK MISSILES, AND IEDS"



TURRET
A solid state electric drive powers the sleek Challenger 2 turret, which is designed with stealth properties to minimise the tank's radar signature. The turret exhibits a 360-degree rotation in a period of nine seconds.

FOUR-MAN CREW INGRESS/EGRESS
The four-man crew is made up of a commander, driver, gunner and loader/operator. Each is equipped with the latest technology for vehicle operation and target acquisition, and enters and exits the tank through secure hatches.

NBC DEFENCE SYSTEM
A sophisticated defence system against nuclear, biological, and chemical weapons (NBC) is located in the turret bustle of the Challenger 2 main battle tank, while the turret itself is designed to reduce the tank's radar signature.

COMMUNICATIONS EQUIPMENT

GUNNER'S PRIMARY SIGHT

POWERPLANT
Challenger 2 is powered by a 12-cylinder, 1,200-horsepower Perkins Caterpillar diesel engine capable of generating a top speed of 59 km/h on the road and 40 km/h cross-country.

THERMAL IMAGING SENSORS

DRIVE SYSTEM
The 1,200-horsepower Perkins Caterpillar diesel engine drives a power train that includes the David Brown TN54 epicyclic transmission with six forward and two reverse gears that are controlled by the Challenger 2 driver.

SECONDARY ARMAMENT
Challenger 2 is armed with a 7.62mm L94A1 EX-34 chain gun mounted in the turret adjacent to the 120mm main gun and at times a pintle-mounted 7.62mm GPMG L37A2.

CHALLENGER 2

- 50 ROUNDS 120MM AMMUNITION CAPACITY
- BOILING VESSEL ALLOWS CREW TO BREW TEA
- UNIT COST EXCEEDS £4.2 MILLION
- APPROXIMATELY 450 UNITS PRODUCED
- WEIGHT OF 62.5 TONS
- OPERATIONAL RANGE OF 550KM
- EXPLOSIVE REACTIVE ARMOUR MINIMISES MISSILE IMPACT
- EXPECTED SERVICE LIFE OF 40 YEARS

Illustration: Alex Pang www.alexpangillustration.com

BATTLE TANK HEROES

Remarkable stories of heroism on the frontline

CAPTAIN HERBERT R MCMASTER

YEARS ACTIVE: 1984-PRESENT

REGIMENT/FORCE: EAGLE TROOP, 2ND ARMORED CAVALRY REGIMENT

Captain Herbert R McMaster was born in Philadelphia, Pennsylvania, on 24 July 1962. A graduate of the US Military Academy at West Point, he deployed during Operation Desert Storm as commander of Eagle Troop, Second Armored Cavalry Regiment. During the Battle of 73 Easting on 26 February 1991, Eagle Troop encountered a large armoured force of the Iraqi Republican Guard's Tawakalna Division.

Although the encounter was something of a surprise and Eagle Troop was significantly outnumbered, McMaster's command destroyed more than 80 tanks and armoured vehicles of the Tawakalna Division. In an impressive display of superior technology and firepower, Eagle Troop dispatched 28 Iraqi tanks, 16 armoured personnel carriers and 30 trucks in the span of just 23 minutes. During the running engagement that ensued, Eagle Troop steadily advanced. Cresting a low rise in the desert landscape, McMaster then spotted a company of Iraqi tanks. His M1A1 Abrams destroyed the first of eight that were directly in front of him, and the accompanying tanks of Eagle Troop accounted for the rest of the enemy armoured vehicles. Minutes later, Eagle Troop ploughed through prepared Iraqi defences, defeated the infantry that stood and fought, and annihilated 18 enemy T-72 main battle tanks. McMaster then ordered a pair of M3 Bradley Cavalry Fighting Vehicles to re-establish contact with neighbouring Ghost Troop on its flank. En route, the two Bradleys wiped out a concentration of up to 13 T-72s with TOW anti-tank missiles.

McMaster handled his 12 M1A1s and accompanying Bradleys skilfully and was awarded the Silver Star in recognition of his performance. He remains active with the US Army and served as an instructor at West Point from 1994-96.

McMaster and his unit destroyed many Iraqi tanks

Lieutenant General Herbert R McMaster led Eagle Troop, Second Armored Cavalry Regiment, at 73 Easting

"MCMASTER HANDLED HIS 12 M1A1S AND ACCOMPANYING BRADLEYS SKILFULLY AND RECEIVED THE SILVER STAR IN RECOGNITION OF HIS PERFORMANCE"

M1A1 Abrams main battle tanks during Operation Desert Storm

EIGHTH KING'S ROYAL IRISH HUSSARS

YEARS ACTIVE: 1693-1958
REGIMENT/FORCE: BRITISH ARMY

From charging enemy lines on horseback during the Great War, Britain's prestigious cavalry regiment soon adopted new metal mounts in the build up to World War II. Initially based in Egypt, the outfit operated in armoured cars and increasingly heavier tanks, fighting in North Africa, Greece and Italy, before taking part in Operation Overlord and the invasion of Europe. However, one of the regiment's toughest tests was still to come with the outbreak of the Korean War in 1950. Now fitted with newer Centurion tanks, the Eighth Hussars were initially stationed north of Pyongyang, but along with all other UN forces, soon found themselves in full retreat.

The Eighth took part in the fight for Hill 327, famously along with the 'Glorious Glosters' regiment, and provided essential support during the fierce Battle of the Imjin River in April 1951. Centurions of the Eighth charged to and from the front of the fighting to relieve and support beleaguered UN forces, among them the decimated Glosters regiment.

By the outbreak of the Korean War, Mark III Centurion tanks had already been in circulation for a few years, fitted with larger and more stable main guns. This gave the British armour greater flexibility, with the ability to fire on the move, and at Imjin River, the Eighth Hussars were able to provide essential covering fire, while making their own hasty withdrawal from the rapidly advancing Chinese.

After the end of the war, the regiment was amalgamated with the Fourth Queen's Own Hussars to form The Queen's Royal Irish Hussars, eventually getting rid of their now aging Centurion battle tanks in favour of the newer Cheiftain series of tanks.

Tanks of the Eighth King's Hussars drive past members of the Glosters

LIEUTENANT ZVIKA GREENGOLD

YEARS ACTIVE: 1972-74
REGIMENT/FORCE: 188TH 'BARAK' BRIGADE

Lieutenant Zvika Greengold was on leave when the surprise Egyptian and Syrian attacks of the Yom Kippur War were launched. An officer of the Israel Defense Forces (IDF), he hitched a ride in a half-track to a forward base at Nafah that was situated at a critical crossroad near the Golan Heights, where Syrian mechanised forces were advancing. However, he was unable to find any operational tanks. The base was crowded with wounded soldiers, and only a few damaged Centurion MBTs sat unattended.

Hurriedly, Greengold directed makeshift repairs then took command of two Centurions, giving the better of the damaged tanks to another officer and climbing aboard the other.

For the next 20 hours, Greengold was constantly engaged with the enemy. As night fell, he encountered Soviet-made T-55 main battle tanks of the Syrian 51st Independent Tank Brigade. Greengold launched an attack on the enemy force. "It was very dark," he told the *Jerusalem Post* in a recent interview. "We were at the Kudna Road. As we drove, I ran into a Syrian tank. I immediately opened fire, and the tank burned."

In the gathering darkness, Greengold lost contact with the other Israeli Centurion. "There was a terrific flash," he told an interviewer, "so I backed away fast. Then I found the radio wasn't working. I moved to the other tank and changed places with its commander. I told him, 'Watch me and do as I do, if possible.' Within a short time, a second Syrian arrived, and we set him ablaze. I saw others, then noticed that the tank alongside me had vanished. I was alone and surrounded from the front and to the right. I fired in both directions, destroying a number [of Syrian tanks], moving backwards all the time. They began to search with lights. I destroyed a few more."

Other Israeli tanks sometimes appeared in support, however, the young officer's Centurion fought alone for an extended period. As the battle wore on and his tank took enemy fire, he was wounded by shrapnel and suffered serious burns. The tank's driver was killed. "At first I saw fire," he recalled. "Suddenly, I realised we were hit. We [the surviving crewmen] lost consciousness. After we woke up, we started running. I asked for more tanks from the commander. My brigade commander told me, 'Don't move from Petroleum Road'."

Several times during the fighting, Greengold was forced to evacuate a stricken or immobilised Centurion and find another mount for himself. When a small supporting force of Centurions rolled forward, he jumped into one of them.

Single-handedly, the intrepid Greengold had convinced the Syrians that they were confronting a much larger force, destroying around 20 to 40 enemy vehicles.

An Israeli tank patrols the Golan Heights in 1973

***Right:** Lieutenant Zvika Greengold executed one of the most amazing feats of tank combat in history*

©Alamy

BATTLE OF 73 EASTING

During Operation Desert Storm, elements of the US-led Coalition's VII Corps destroyed two brigades of the Iraqi Tawakalna Division in combat

Advancing through southern Iraq towards the Kuwaiti border on 26 February 1991, the second day of the ground phase of Operation Desert Storm, the US Second Armored Cavalry Regiment brushed aside Iraqi tanks at 60 Easting, a location designating map co-ordinates in the trackless desert. It then moved on to decimate the Iraqi 18th Mechanized and 37th Armored Brigades at 73 Easting. Along with elements of the British First Armoured Division, the American forces destroyed about 160 enemy tanks and armoured vehicles, many of them the Soviet-built T-55, T-72 and BMP-1, during approximately 80 hours of intense fighting.

"12 EAGLE TROOP M1A1 TANKS DESTROY 28 IRAQI TANKS AND OVER 40 OTHER VEHICLES"

1. POISED TO STRIKE
The Coalition masses overwhelming force along the Iraqi-Kuwaiti frontier for the ground phase of Desert Storm. The offensive will include a mechanised 'left hook' cutting off Iraqi units from the west and a strike towards Kuwait City and the vital oil fields.

2. RETRIBUTION UNLEASHED
On 24 February 1991, following days of heavy aerial bombardment to soften up prepared Iraqi defences, the Coalition launches ground operations. The VII Corps breaches the Iraqi defensive line and begins a rapid advance towards the interior of the country.

3. HAIL MARY
In a manoeuvre that is nicknamed the 'Hail Mary', the VII Corps races from its jump-off locations in Saudi Arabia with the mission of cutting off any Iraqi retreat from Kuwait and destroying the capability of the Iraqi Army to wage war.

4. LIGHT SPORADIC RESISTANCE
Although the Coalition forces are prepared to engage immediately in heavy combat, the initial advance encounters only light resistance, and the offensive gains momentum rapidly. The Second Armored Cavalry Regiment moves generally north-eastward as a scouting unit.

5. RAPID MOVEMENT
On the leading edge of the north-eastward Coalition advance, the Second Armored Cavalry Regiment moves forward rapidly with the intent of finding and fixing the Tawakalna Division of the Iraqi Republican Guard. The regiment meets only sporadic enemy resistance along the way, until 25 February.

6. HASTY DEFENCE
As the Second Armored Cavalry Regiment pushes forward, small groups of Iraqi infantrymen attempt light resistance with small-arms fire. These troops are occasionally supported by a tank or armoured vehicle, which is quickly destroyed. The Iraqis typically surrender after firing a few rounds.

7. MORNING MANOEUVRE
Early on 26 February, elements of the Second Armored Cavalry Regiment defeat several companies of the Iraqi 50th Brigade and receive orders to adjust its boundary with the British First Armoured Division to the south, destroying an Iraqi T-72 tank subsequent to the manoeuvre.

8. BATTLE JOINED
By late morning, a fierce sandstorm restricts visibility. All three squadrons of the Second Armored Cavalry Regiment engage the Tawakalna Division near 60 Easting. At noon, the Third Squadron reports destroying 23 Iraqi T-55 tanks, 25 armoured personnel carriers and other vehicles.

9. THROUGH 70 EASTING
Although ordered to avoid a general engagement, the Second Armored Cavalry Regiment encounters increasing resistance as it moves from 60 Easting with eight of its nine cavalry troops abreast. At approximately 3.45pm, Eagle Troop heads along 70 Easting, and the fight spreads southwards.

10. DECISION AT 73 EASTING
Second and Third Squadrons, Second Armored Cavalry Regiment, encounter tanks of the Tawakalna Division, many located in prepared positions. Outnumbered three-to-one, they annihilate the Iraqis. 12 Eagle Troop M1A1 tanks destroy 28 Iraqi tanks and over 40 other vehicles in less than 30 minutes.

CAVALRY TROOPS CLOSE IN

WITHIN MINUTES OF THE INITIAL EAGLE TROOP CONTACT WITH THE TAWAKALNA DIVISION, MORE SECOND ARMORED CAVALRY REGIMENT FORCES CONVERGE

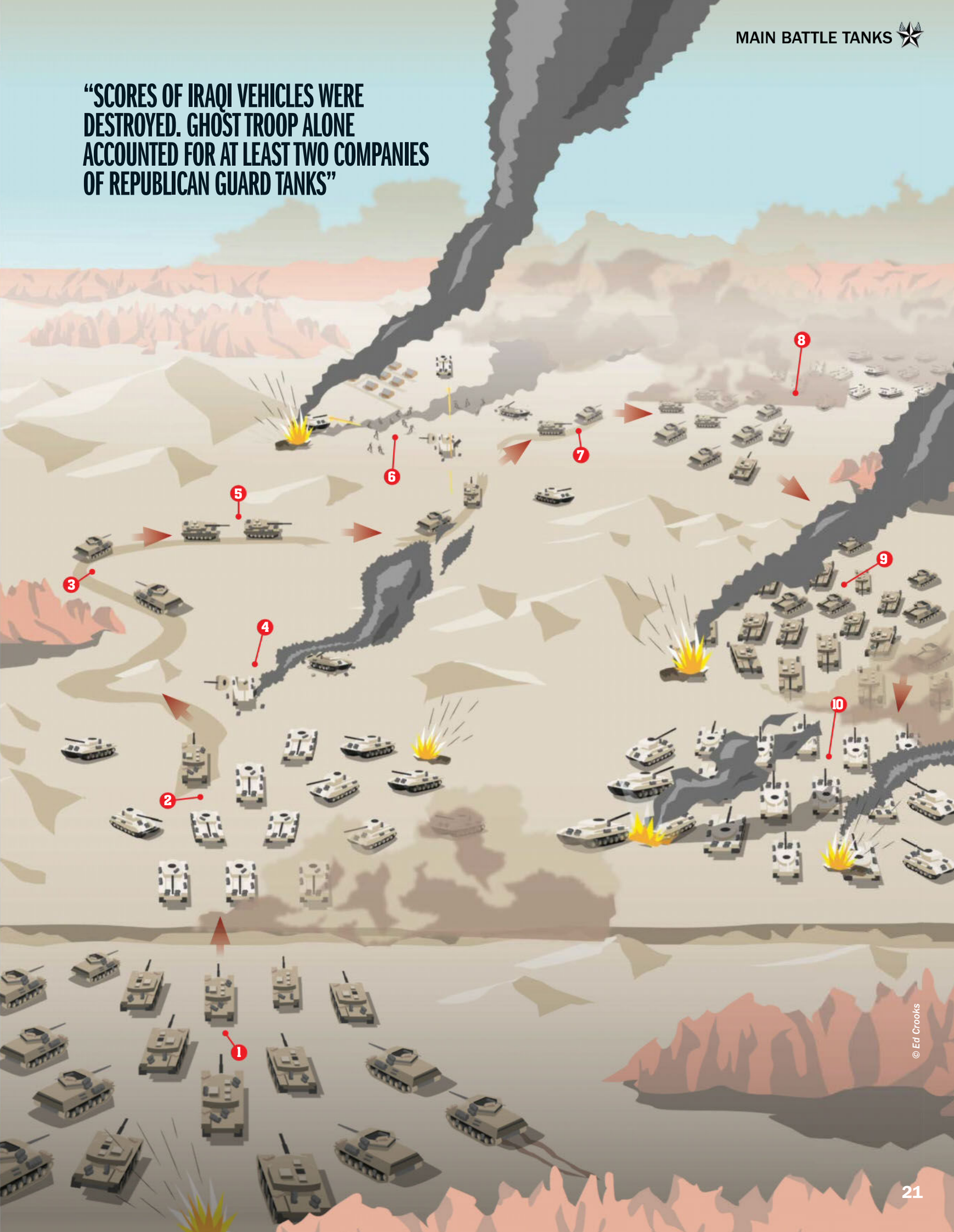
From the time that the Battle of 73 Easting was joined, visibility was poor due to a raging sandstorm, and the fight occurred somewhat by accident. However, as Eagle Troop encountered the Tawakalna Division, other American forces, including Ghost, Killer, and Iron Troops of the Second and Third Armored Cavalry Regiments, entered the fight quickly.

Bradley Fighting Vehicles destroyed a number of Iraqi tanks and armoured personnel carriers with TOW missiles after fixing their targets with 25mm gunfire, while the highly sophisticated M1A1 Abrams main battle tanks utilised superior optics and target-acquisition systems to defeat two brigades of the Tawakalna Division and later elements of the Iraqi 12th Armored Division during six hours of heavy fighting.

Ghost Troop alone accounted for at least two companies of Republican Guard tanks. The American forces allegedly sustained only a single combat death and the loss of one Bradley Fighting Vehicle at 73 Easting. Accurate artillery and air support, although restricted by poor visibility, were key elements in the repulse of Iraqi counterattacks during the fight, which is recognised by some historians and military observers as the last great armoured battle of the 20th century.

The superior M1A1 Abrams tanks gave the Coalition a technological advantage over the Iraqis

"SCORES OF IRAQI VEHICLES WERE DESTROYED. GHOST TROOP ALONE ACCOUNTED FOR AT LEAST TWO COMPANIES OF REPUBLICAN GUARD TANKS"



MAIN BATTLE TANKS OF THE WORLD

The proliferation of the main battle tank has placed the armoured vehicle in service with armies across the globe

1 BATTLE OF THE IMJIN RIVER

KOREAN PENINSULA 22-25 APRIL 1951

During the initial action of the Chinese spring offensive during the Korean War, Centurion main battle tanks of the British Eighth Hussars contribute to the efforts of a multinational force in stemming the Chinese advance.

Above: Men of the 3rd Battalion Royal Australian Regiment crowd onto a Centurion tank to cross the Imjin River

BRITISH MAIN TANKS

CENTURION
In service: 1946-present

CHIEFTAIN
In service: 1966-present

CHALLENGER 2
In service: 1998-present

Above: A French AMX-30 main battle tank in desert camouflage

AMX-30
Origin: France
In service: 1966-present

US MAIN TANKS

M48
In service: 1953-present

M1 ABRAMS
In service: 1980-present

2 BATTLE OF CHAWINDA

CHAWINDA, PAKISTAN
14 AND 18-19 SEPTEMBER 1965

In the largest armoured battle since Kursk, the Pakistani army halts the Indian army's invasion. British-made Centurion and American-built M47 and M48 Patton Tanks are deployed by the belligerents.

Destroyed Patton and Sherman tanks of the Pakistani Army in September 1965

3 BATTLE OF ABU-AGEILA

SINAI DESERT, EGYPT 5-6 JUNE 1967

During the Six-Day War, Israel Defense Forces deploy 150 tanks, many of them Centurions, to decisively defeat an Egyptian force, knocking out at least 40 older Soviet-made T-34/85 tanks of World War II vintage.

"MAIN BATTLE TANKS ARE OFTEN LIMITED OPERATIONALLY DUE TO JUNGLE AND ADVERSE TERRAIN"

4 VIETNAM CONFLICT

VIETNAM, SOUTHEAST ASIA 1945-75

After WWII, communist North Vietnam eventually exerts control over all territory of the former French colony of Indochina. Main battle tanks are often limited operationally due to jungle and adverse terrain.

A convoy of American M48 Patton tanks and M113 personnel carriers halts along a road in South Vietnam

Left: A T-62 main battle tank of the Soviet Red Army lays a smokescreen

SOVIET MAIN TANKS

T-54
In service: 1946-present

T-72
In service: 1973-present

T-62
In service: 1961-present

T-80
In service: 1976-present

T-90
Origin: Russia
In service: 1993-present

Right: An original T-54, The Soviet Union's first main battle tank

5 BATTLE OF THE VALLEY OF TEARS

GOLAN HEIGHTS, ISRAELI-SYRIAN FRONTIER 6-9 OCTOBER 1973

At the height of the Yom Kippur War crisis, Israeli forces, including a relative few Centurion main battle tanks, make a heroic stand against invading Syrian troops and Soviet-made T-54/55 tanks.

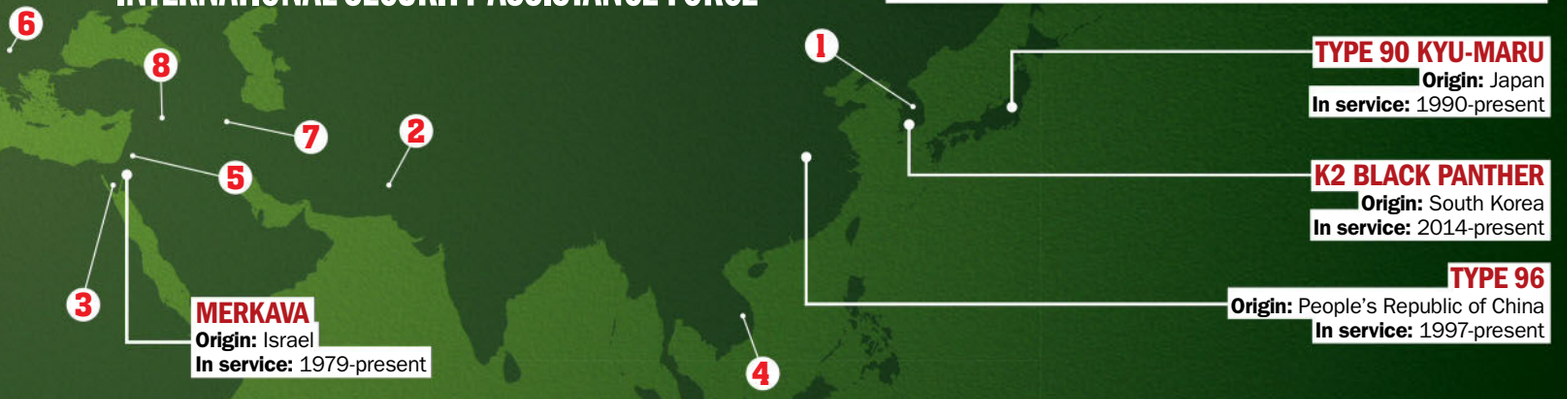
6 KOSOVO WAR

KOSOVO, YUGOSLAVIA, BALKANS FEBRUARY 1998 – JUNE 1999

With NATO support, the Kosovo Liberation Army secures the withdrawal of Yugoslavian forces from its territory. Main battle tanks such as the German Leopard 2 are deployed to Kosovo with the International Security Assistance Force.

The German-designed Leopard 2 main battle tank deployed with the armed forces of several nations in Kosovo to maintain a tenuous peace

"MAIN BATTLE TANKS SUCH AS THE GERMAN LEOPARD 2 ARE DEPLOYED TO KOSOVO WITH THE INTERNATIONAL SECURITY ASSISTANCE FORCE"



TYPE 90 KYU-MARU
Origin: Japan
In service: 1990-present

K2 BLACK PANTHER
Origin: South Korea
In service: 2014-present

TYPE 96
Origin: People's Republic of China
In service: 1997-present

MERKAVA
Origin: Israel
In service: 1979-present

7 BATTLE OF BAGHDAD

BAGHDAD, IRAQ 3-12 APRIL 2003

During the culmination of the US-led coalition invasion of Iraq to topple dictator Saddam Hussein, US armoured forces take control of the Iraqi capital, destroying enemy tanks with great precision.

Right: M1 Abrams main battle tanks of the US Marine Corps patrol a street in the Iraqi capital of Baghdad after its capture in April 2003

8 SYRIAN CIVIL WAR

SYRIA MARCH 2011-PRESENT

During an ongoing, multifaceted civil war, the military of Syrian President Bashar al-Assad has employed Soviet-built main battle tanks such as the T-54/55 and T-72 in an effort to defeat insurgencies.

Below: Two destroyed Syrian Army main battle tanks lie amid the rubble of a mosque following a 2012 battle in the city of Azaz

Images: FreeVectorMaps.com, Getty

HEAD TO HEAD

The tough but flawed Soviet-era workhorse faces off against the cream of the USA's triumph of military tech

M1A1 ABRAMS

YEARS IN OPERATION: *1986-PRESENT*
ORIGIN: *USA* **NUMBER MADE:** *5,000*

FIREPOWER

The M1A1 Abrams main battle tank mounts the M256 120mm smoothbore cannon, capable of firing a variety of ammunition. Designed by Rheinmetall, the cannon is also mounted on the German Leopard 2.

TECHNOLOGY

The tank deployed with cutting-edge target-acquisition and battlefield-control technology, surpassing that of enemy vehicles in single combat during numerous encounters in Iraq and other locations in the Middle East.

ARMOUR

Composite armour based on the British Chobham innovation provides outstanding protection for the M1A1 against anti-tank missiles and cannon rounds. Upgraded from the original M1, some M1A1 armour includes depleted uranium.

SPEED

The 1,500-shaft horsepower Honeywell AGT 1500 multifuel gas turbine engine of the Abrams MBT, complemented with an Allison X-1100-3B hydrokinetic automatic transmission, delivers a top speed of 45 miles per hour.

LEGACY

The M1A1 Abrams MBT is a state-of-the-art, war-winning weapon. Although a relative few M1A1s have been destroyed or damaged by friendly and enemy fire, the tank's survivability is excellent.

TOTAL

SUPERIOR UPGRADES

Produced from 1986 to 1992, the M1A1 Abrams was an improvement to the original M1 Abrams, which made its debut in the late 1970s following a failed joint venture with the Federal Republic of Germany. The M1A1 introduced such upgrades as a pressurised NBC (nuclear, biological and chemical) defence system and improved armour protection, better storage areas for supplies and personal gear, and the M256 smoothbore cannon to replace the M68A1 105mm rifled tank gun. Approximately 5,000 M1A1 Abrams main battle tanks were manufactured for the US Army, Marine Corps and the armed forces of other nations.

Photographed at Camp Fallujah, Iraq, in January 2007, US Marines perform permission checks on an M1A1 Abrams main battle tank

A convoy of Soviet T-72 main battle tanks, their commanders riding in open turrets, moves forward in this image taken in 1985

QUANTITY OVER QUALITY

Although it remains in service with armies around the world, the T-72 is, in the eyes of some observers, a relic of the Cold War, particularly due to its variance in combat effectiveness due to limited technological upgrade opportunities. The T-72 entered service in the early 1970s as an export main battle tank emanating from the introduction of the earlier T-64, and has populated the armoured formations of armies in at least 40 countries. While it has demonstrated tremendous longevity, the T-72, in its various configurations, has regularly proven inferior in combat to subsequent generations of Western main battle tanks.

"The T-72 lacked the highest quality Soviet-era technology, and many of those in service today remain inferior"

T-72

YEARS IN OPERATION: *1973-PRESENT*
ORIGIN: *SOVIET UNION/RUSSIA* ***NUMBER MADE:*** *25,000*

FIREPOWER

The 125mm 2A46M/2A46M-5 smoothbore gun is slightly larger in calibre than the main weapons of most Western tanks. Although effective, design limitations restrict its elevation and the probable accuracy of its fire.

TECHNOLOGY

Due in part to its original development for the export market, the T-72 lacked the highest quality Soviet-era technology, and many of those in service today remain inferior when compared with Western technological upgrades.

ARMOUR

Later variants of the T-72 were equipped with Kontakt-5 explosive reactive armour, quite effective against contemporary Western tank rounds. Basic armour production then steadily improved.

SPEED

The Soviet-era 780-horsepower V-12 diesel engine and synchromesh transmission of the T-72 main battle tank produced a top speed of 37 miles per hour. Subsequent powerplants were improved, however.

LEGACY

One of the most widely produced main battle tanks in modern history, with more than 20,000 reportedly made, the T-72, nicknamed 'Ural', is also one of the most common among global armed forces.

TOTAL

ZERO

Illustration: Alex Pang

After years of supremacy at sea, Dönitz's wolf pack faced a new threat from the Allies' air forces

"A STORM HAD WHIPPED UP THAT WAS SO FEROCIOUS THAT THE CONVOY, WITH DWINDLING FUEL, WAS FORCED TO KEEP STEAMING ALONG THE DOOMED COURSE FATE HAD SELECTED FOR IT – DIRECTLY INTO THE U-BOATS' KILLING GROUND"

SUB HUNTERS

BATTLE OF THE ATLANTIC

Lasting almost six years, the struggle to control the shipping routes across the ocean was the longest-running campaign of World War II

WORDS **NICK SOLDINGER**

The Anglo-Canadian convoy SC 42 left Nova Scotia bound for England on 30 August 1941. It consisted of more than 60 slow-moving merchant ships protected by four warships from the Royal Canadian Navy. Ahead of it lay 4,500 kilometres of wild ocean, temperatures cold enough to freeze the sea spray to the ships' handrails, and waves the size of tower blocks.

The crossing, which would take the ships a minimum of two and half weeks to complete, held a far deadlier threat than anything the environment could throw at them, however. Shortly after leaving port, the lumbering fleet got word from British intelligence that a vast wolf pack of German U-boats was prowling off the coast of Greenland. Ordinarily, such information would have allowed the convoy to reroute and avoid the waiting menace – but not this time. A storm had whipped up that was so ferocious that the convoy, with dwindling fuel, was forced to keep steaming along the doomed course fate had selected for it – directly into the U-boats' killing ground.

By now Britain had been at war with Nazi Germany for two years. Isolated from the rest of Europe for much of that time and blockaded by the German navy, it had relied on its ally Canada to keep it alive – literally. When Hitler's plan to invade the UK in 1940 faltered in the wake of the Battle of Britain, he switched tactics – if the island was a fortress, then he'd besiege it. Blitzed from the air and starved of supplies from the sea, the country was by this time nearing exhaustion. It was desperate for the supplies SC 42 was bringing. Much of it however, tragically never finished the journey.

The man Hitler had chosen to choke off Britain's food supply was Admiral Karl Dönitz. A veteran U-boat commander from World War I, he was a brilliant tactician, ruthless in battle and respected by his men. It was his controlling nature over the U-boat fleet, however, that would cost him what would come to be known as the Battle of the Atlantic.

In the autumn of 1941, it was a weakness that had yet to manifest itself in the outcome of this war under the waves; Dönitz was apparently winning the struggle. His U-boats were sinking nearly 150,000 tons of Allied shipping a month, and Convoy SC 42 was about to significantly add to that tally when, ten days into the crossing, it blundered into the jaws of the lurking wolf pack.

In the early hours of 9 September, the U-boats attacked their first merchant ship. Surfacing under cover of darkness to both keep pace with the convoy and avoid detection by the underwater sonar devices on the warships, the British freighter Empire Springbuck was the first to be picked off – all 39 of its crew were lost. When night fell the following evening, the U-boats struck again. Next to go was SS Muneric, with the loss of all 63 crewmen.

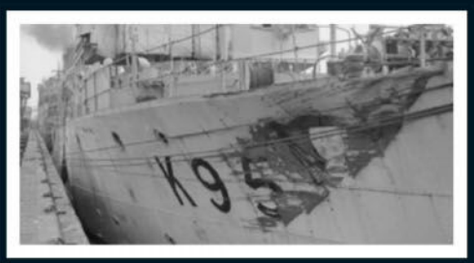
Hours later, another ship, the SS Baron Pentland, was damaged and abandoned by its crew. Within three hours, three more ships were destroyed. This continued for eight long days and nights. By the time SC 42 escaped the clutches of Dönitz's cut-throats, 16 ships had been sunk with the loss of more than 200 lives and thousands of tons of vital supplies. Back at his HQ in Brittany, where Dönitz had orchestrated the killings using charts and encrypted radio signals, these horrendous losses were toasted with fine local wines. Little was the Nazi admiral to know, however, that this was the last time his hunters would enjoy such overwhelming success.

THE WAR UNDER THE WAVES

INCREASINGLY SOPHISTICATED TECHNOLOGY PLAYED A KEY ROLE IN DETERMINING WHO EMERGED VICTORIOUS FROM THE DEADLY DUEL ON THE HIGH SEAS

Perhaps more than any battle in history, the one for control of the Atlantic shipping lanes during World War II demonstrated the importance of technology in warfare. Since humans first began engaging in organised conflict thousands of years ago, the victors have almost exclusively been those with the technological edge. When World War II began, it was the German navy, which had been preparing for war for years and who in Admiral Dönitz had a master strategist, that looked best prepared for victory. However, Britain, along with its ally Canada and later the US, developed an astonishingly rapid and sophisticated response to the U-boat threat that ultimately proved irresistible.

Dönitz insisted on a top-down command structure, ensuring he micro-managed every single engagement with Allied shipping from his war room, which from the summer of 1940 was in Lorient, Western France. This obsessive planning ultimately made his submarine crews vulnerable to intelligence leaks. With the cracking of Germany's supposedly unbreakable Enigma code in 1941, which Dönitz used to communicate with his U-boat commanders and move his wolf packs around his maritime maps, the fate of Germany's U-boat fleet was sealed. Then, with an array of ground-breaking detection devices and bespoke weaponry, it was eventually destroyed.



***Above:** Ramming U-boats was another tactic used by allied naval commanders – often resulting in considerable damage to their own ships*

Depth charges were fired off the side of Allied warships. The underwater explosions they created broke the U-boats' hulls with shockwaves

CATALINA FLYING BOAT

CORVETTE
Dubbed the "cheap and nasties" by Churchill because they were cheap to produce and supposedly nasty for the U-boats, these smaller warships were based on whaling ships, whose engines were thought to be ideal for chasing subs, which they could then attack with their four-inch guns and depth charges. Mass produced and rushed into service with the then tiny Royal Canadian Navy, they struggled badly in the rough seas and violent weather of the North Atlantic.

LEIGH LIGHT
Dubbed 'the dustbin' because of its shape, this 22-million candlepower, 24-inch retractable searchlight was slung underneath the fuselage of sub-hunting Allied aircraft. When an unsuspecting U-boat was suddenly pounced upon from above while travelling on the surface, the light was switched on and the sub illuminated. This not only made it easier for the attacking aircraft to hit it, but it also blinded the U-boat's crew in the first few vital moments of the attack as they struggled to respond.

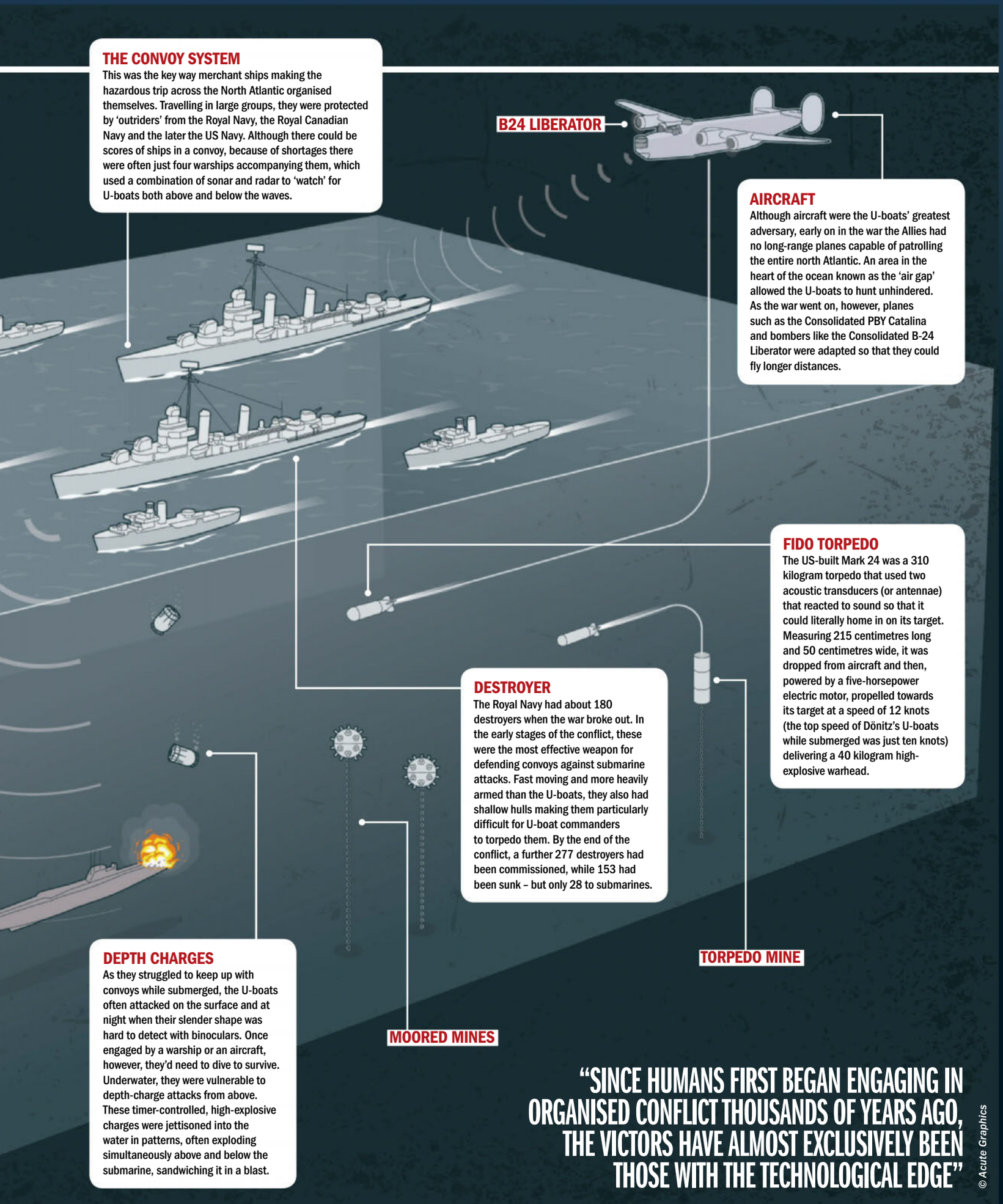
DRIFTING/FLOATING MINES

HEDGEHOG
This forward-firing mortar spat groups of 24 missiles up to 250 metres from the deck of a corvette or a destroyer as it chased down a submerging U-boat. Its shells would only explode if they actually made contact with the evading U-boat, which meant the sonar wasn't disturbed if the shell missed. More deadly than depth charges, which relied on hydrostatic shockwaves to score a kill, the hedgehogs' missiles would punch a hole directly into the U-Boat's hull.

RISING MINE

SONAR
The British had developed sonar before the war, using directional sound waves to 'see' underwater. These bounced off the U-boats and were heard back as an echo. The quicker the return of the echo, the closer the submarine. Listened in to by a radio operator, they had a range of about 275 metres – ideal if a submarine was close, less so if it was at the limit of its torpedo range, which, at the outbreak of war, was about three kilometres.

INTELLIGENCE
The work done by Alan Turing and his team of code breakers at Bletchley Park was key to the Allied victory, not just in the Battle of the Atlantic but the entire war. Their cracking of the Enigma code in 1941 enabled the Royal Navy's Western Approaches Command to effectively see every play Dönitz was making as he was making it, and simply steer the convoys away from or around his lurking wolf packs.



THE CONVOY SYSTEM

This was the key way merchant ships making the hazardous trip across the North Atlantic organised themselves. Travelling in large groups, they were protected by 'outriders' from the Royal Navy, the Royal Canadian Navy and the later the US Navy. Although there could be scores of ships in a convoy, because of shortages there were often just four warships accompanying them, which used a combination of sonar and radar to 'watch' for U-boats both above and below the waves.

AIRCRAFT

Although aircraft were the U-boats' greatest adversary, early on in the war the Allies had no long-range planes capable of patrolling the entire north Atlantic. An area in the heart of the ocean known as the 'air gap' allowed the U-boats to hunt unhindered. As the war went on, however, planes such as the Consolidated PBY Catalina and bombers like the Consolidated B-24 Liberator were adapted so that they could fly longer distances.

FIDO TORPEDO

The US-built Mark 24 was a 310 kilogram torpedo that used two acoustic transducers (or antennae) that reacted to sound so that it could literally home in on its target. Measuring 215 centimetres long and 50 centimetres wide, it was dropped from aircraft and then, powered by a five-horsepower electric motor, propelled towards its target at a speed of 12 knots (the top speed of Dönitz's U-boats while submerged was just ten knots) delivering a 40 kilogram high-explosive warhead.

DESTROYER

The Royal Navy had about 180 destroyers when the war broke out. In the early stages of the conflict, these were the most effective weapon for defending convoys against submarine attacks. Fast moving and more heavily armed than the U-boats, they also had shallow hulls making them particularly difficult for U-boat commanders to torpedo them. By the end of the conflict, a further 277 destroyers had been commissioned, while 153 had been sunk – but only 28 to submarines.

DEPTH CHARGES

As they struggled to keep up with convoys while submerged, the U-boats often attacked on the surface and at night when their slender shape was hard to detect with binoculars. Once engaged by a warship or an aircraft, however, they'd need to dive to survive. Underwater, they were vulnerable to depth-charge attacks from above. These timer-controlled, high-explosive charges were jettisoned into the water in patterns, often exploding simultaneously above and below the submarine, sandwiching it in a blast.

MOORED MINES

TORPEDO MINE

"SINCE HUMANS FIRST BEGAN ENGAGING IN ORGANISED CONFLICT THOUSANDS OF YEARS AGO, THE VICTORS HAVE ALMOST EXCLUSIVELY BEEN THOSE WITH THE TECHNOLOGICAL EDGE"

BIRDS OF PREY

HOW AIRCRAFT BECAME THE KEY WEAPON FOR THE ALLIES IN CONTAINING AND DESTROYING THE MENACE OF DÖNITZ'S WOLF PACKS

The British rightly realised that air power was the key to defeating the U-boat scourge. Within weeks of war breaking out, HMS Courageous, one of the Royal Navy's seven aircraft carriers, was despatched to the Atlantic to hunt for subs. It had 48 Fairey Swordfish torpedo planes on board, and an escort of four destroyers. Courageous was patrolling the seas off northwest Ireland when, on 17 September 1939, it was sunk by U-29 with the loss of more than 500 crew. It was a devastating blow for the Royal Navy, which responded by restricting its remaining six carriers to areas where there was no risk of U-boat attack.

This presented a real problem, because Allied aircraft at that stage of the war simply didn't have the range to cover what was effectively a huge battlefield. The air gap that opened up in the heart of the Atlantic now became the wolf packs' chief hunting ground.

To counter this, the Allies established air bases on Iceland, Greenland and the Faroe Islands, and set about trying to source aircraft that could close the gap further. Britain had considerable pre-war experience of the flying boat and their versatility proved useful during the early stages of the battle, but the ideal long-range maritime patrol aircraft needed to be based on a bomber design. Unfortunately, such aircraft were hard to find as the strategic aerial bombing of occupied Europe was, for much of the war, the only means Britain and the Allies had of hitting back at the Germans. The answer came in the shape of the Consolidated B24 Liberator.

Unlike modern submarines, the German U-boats were not designed to spend weeks under the water. Rather they were viewed as torpedo boats that had the capability of diving as a defensive strategy, and once submerged they were reliant on battery power to propel themselves through the water. These batteries needed regular recharging – something that could only be done by the boat's diesel motors acting as a dynamo when the vessel was on the surface. In the early stages of the war, the U-boats could prowl around on the surface in the air gap pretty much untroubled day or night. By 1942, however, once the Liberator had been fitted with both radar and Leigh Lights, and adapted to fly for longer, it was used, in conjunction with Dönitz's intercepted and decrypted communiqués, to effectively shut the air gap once and for all.

"B-24 LIBERATORS MANAGED TO SINK MORE THAN 70 U-BOATS DURING THE BATTLE OF THE ATLANTIC"

SHORT SUNDERLAND

OPERATOR: RAF COASTAL COMMAND, ROYAL CANADIAN AIR FORCE
IN SERVICE: 1938-59 RANGE: 2,848KM

With a crew of 11, equipped with Air-to-Surface Vessel radar (ASV), and armed with eight depth charges and as many as 16 .303 browning machine guns, the Short Sunderland was used to provide top cover for merchant convoys, patrol harbour approaches and hunt down Dönitz's wolf packs. This they did with huge success – some 60 U-boats were destroyed during the war by this particular aircraft. They were also used to pick up survivors of torpedoed ships despite not being designed to land on rough open sea. This heroic yet dangerous practice was eventually outlawed by RAF Coastal Command in 1942.

A Short Sunderland prepares for take off

CONSOLIDATED PBY CATALINA

OPERATOR: RAF COASTAL COMMAND, ROYAL CANADIAN AIR FORCE, US NAVY
IN SERVICE: 1936-57 RANGE: 4,000KM

Armed with five .50-calibre machine guns – including two waist gunners in the plane's distinctive 'blister' pods on its sides – and capable of carrying as much as 1,800 kilograms on its wings' bomb racks, this beast of a machine was crewed by ten men. Like the Sunderland, it was also equipped with ASV and undertook sub-hunting duties as well as convoy-protection missions. This ubiquitous plane managed to destroy 40 U-boats during the Battle of the Atlantic with two Catalina pilots – Flying Officer John Cruickshank of the RAF and Flight Lieutenant David Hornell of the RCAF – winning Victoria Crosses in the process.

Catalina Z2147 was credited with nine successful U-boat attacks during its service

Almost 19,000 Liberators were produced during its life span

CONSOLIDATED B-24 LIBERATOR

OPERATOR: RAF COASTAL COMMAND, ROYAL CANADIAN AIR FORCE, UNITED STATES ARMY AIR FORCE, US NAVY
IN SERVICE: 1939-57 RANGE: 3,220KM

Produced in greater numbers than any other US bomber during World War II, the Consolidated B-24 Liberator was the key aerial weapon in the war against Dönitz's wolf packs. Crewed by ten men, once fitted with long-range fuel tanks from 1942 onwards it could stay airborne for up to 18 hours at a time. Armed with ten 12.7mm machine guns and equipped with ASV and the Leigh Light, it would attack with a formidable arsenal of weapons including torpedoes, bullets, bombs, rockets and depth charges. In all, B-24 Liberators managed to sink more than 70 U-boats during the Battle of the Atlantic.

“THE AIR GAP THAT OPENED UP IN THE HEART OF THE ATLANTIC NOW BECAME THE WOLF PACKS’ CHIEF HUNTING GROUND”

German submarine U-134 is attacked from the air

DEFENDING BRITAIN'S COAST

THE SYSTEM IMPLEMENTED TO KEEP THE U-BOATS OF BRITISH PORTS OUT WAS INGENIOUS AND COMPLEX

Britain's ports played a pivotal role in protecting the Atlantic convoys. After all, these were where the ships that confronted the U-boats sailed to and from, so it was little wonder that this might make them highly valuable targets for U-boat attacks themselves.

The British had actually been aware of this possibility long before hostilities broke out. Indeed some of the technology the British would use – such as steel anti-submarine netting known as indicator nets draped across harbour entrances – had proved their worth in World War I when a number of German U-boats became ensnared in them and were subsequently sunk with depth charges. In fact, preparations were being made for a revival of the defence around Britain's more important ports as early as 1938.

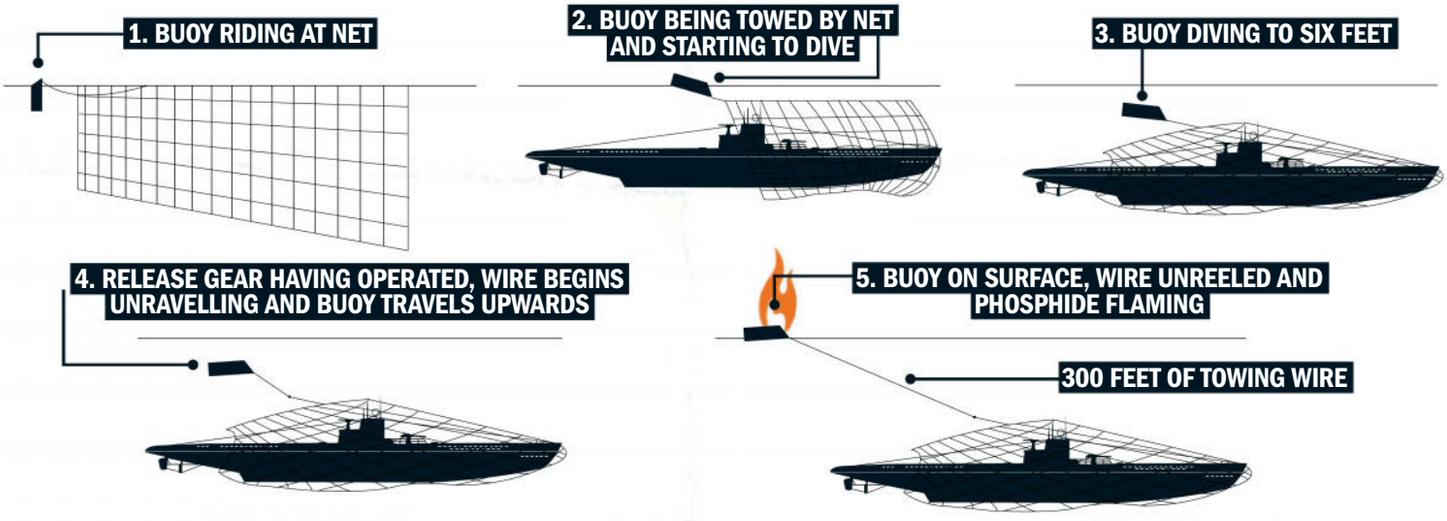
Work readying the Clyde Estuary for war, for example, was started in the wake of the notorious Munich Conference, which British PM Chamberlain had returned from promising the British people that war with Hitler had been averted. It hadn't, of course, and when hostilities broke out less than a year later, a huge steel indicator net had already been manufactured that was swiftly hauled into position by eight boom ships to seal off the Clyde from U-boats.

"PREPARATIONS WERE BEING MADE FOR A REVIVAL OF THE DEFENCE AROUND BRITAIN'S MORE IMPORTANT PORTS AS EARLY AS 1938"

Large wooden or metal floats, like these barrel floats, helped keep the huge suspended nets in place

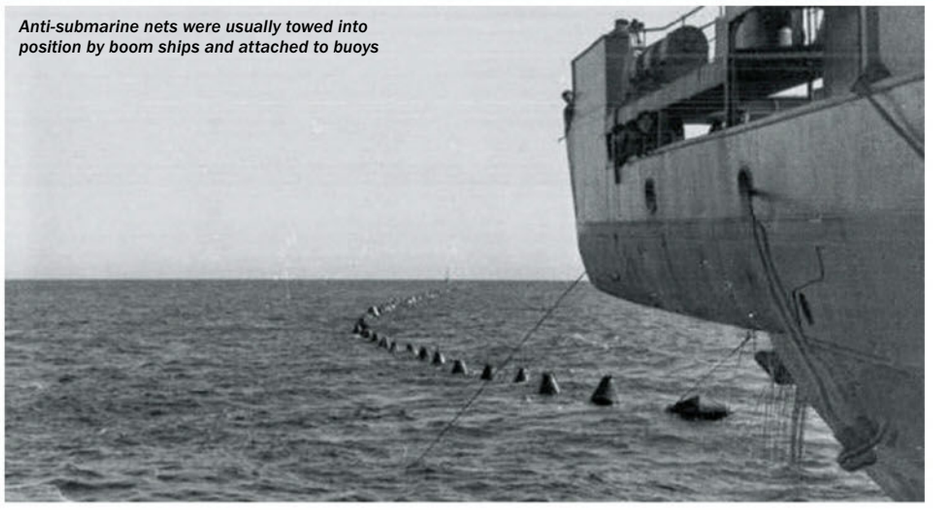
PRAM INDICATOR BUOY WITH HYDROSTATIC RELEASE

WHEN A U-BOAT BECAME ENSNARED IN AN INDICATOR NET, THE BURNING BUOY GAVE AWAY THE ENEMY BELOW



Elsewhere around Britain's coastline, and indeed across its empire, these indicator nets – which could be as long as 100 metres and as deep as the sea bed they were suspended over – and an increasingly complex series of defences would play their part in keeping the U-boats out.

The nets, which had a series of rocket flares attached to them that would go off if a submarine tried to breach the defences, were also sometimes attached to converted fishing boats armed with machine guns and depth charges. Other methods of defence around British harbours could include extensive minefields, sonar listening posts, radar stations, land-based gun emplacements, patrol ships, out-post observation ships, and of course regular sorties by aircraft from the RAF's Coastal Command. In combination, they proved a highly effective deterrent to Dönitz's U-boats.



Anti-submarine nets were usually towed into position by boom ships and attached to buoys

THE GREATEST DISCOVERY OF THE WAR

WHEN ONE BRITISH OFFICER BOARDED AN ABANDONED U-BOAT, LITTLE DID HE KNOW HE WOULD MAKE A HISTORY-CHANGING FIND

On 9 May 1941, U-boat ace Fritz-Julius Lemp, commander of U-110, attacked a convoy just south of Iceland. He hit two ships before being spotted by the British destroyer HMS Bulldog, which turned and raced towards him. Lemp, realising the danger, dived, but it was too late. The Bulldog was soon on top of him, and he and his crew could hear depth charges crashing into the water.

Lemp's crew knew what was coming, and waited in agonising silence for the inevitable shockwaves from the explosions. When they came, they were horrific. "The vibrations were so bad," Georg Högel, Lemp's then 21-year-old radio operator, later recalled, "that we knew we couldn't escape. Lemp then gave the order to surface." As U-110 made its way up from the ocean floor to surrender, HMS Bulldog fired on it with every weapon it had. So intense was the fire that rained down upon it that when it surfaced, U-110's terrified crew poured from its hatches and leapt into the sea.

"Lemp stood on the conning tower shouting, 'Get out, everybody get out'," Högel remembered. "Us two radio operators were down in the control room so we called out, 'What about the secret machines?' [Lemp replied,] 'Leave everything in there, get out!' He just wanted to save every man."

Lemp was killed in the confusion as his crew abandoned U-110 believing that it was sinking. Somehow, though, the submarine stayed afloat. On HMS Bulldog, 20-year-old Sub-Lieutenant David Balme was then given the nod by his commander to lead a boarding party. "We rowed over," Balme recalled years later. "I got out and walked along the deck with my revolver pointing. All the hatches were open but you didn't know how many Germans might still be down below. That was the frightening thing because you needed both hands to go down those ladders. So I holster my revolver and gradually go down, and there I was in the control room. Absolutely silent, no Germans, just me. So I called my boarding party down and we started searching the U-boat."

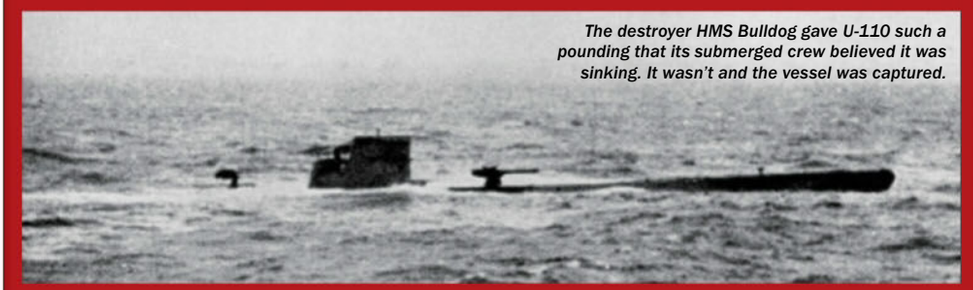
What happened next was one of World War II's most significant events. As Balme's men searched the abandoned submarine, they found not only the U-boat's codebook but an intact Enigma machine – the secretive device used to encrypt and decrypt German radio signals.

The machines were raced back to the British codebreaking centre at Bletchley Park, where some of Britain's best minds had been struggling to crack Enigma's riddle. The machine, a more up-to-date version of the pre-war one they had been working with, swiftly provided a breakthrough.

Using it, Bletchley's star codebreaker Alan Turing identified a pattern in the first communiqués being intercepted each day between U-boat commanders and Dönitz. Realising that these messages were weather reports, he slowly began to unravel Enigma, eventually developing the Turing bombe – a huge proto-computer capable of working through thousands of code variations simultaneously – to crack it. The chance capture of Lemp's Enigma machine became one the greatest pieces of good fortune in the history of warfare.

***Below:** The discovery of the newer Enigma machine helped codebreakers break the cipher*

"AS BALME'S MEN SEARCHED THE ABANDONED SUBMARINE, THEY FOUND NOT ONLY THE U-BOAT'S CODEBOOK BUT AN INTACT ENIGMA MACHINE"



The destroyer HMS Bulldog gave U-110 such a pounding that its submerged crew believed it was sinking. It wasn't and the vessel was captured.

WORDS **LEIGH NEVILLE**

10 DEADLIEST SNIPERS

Scoring the longest shots or the highest number of kills, take a look at history's most lethal battlefield hunters

From the Spanish marksman who killed Admiral Horatio Nelson at Trafalgar to the shadowy Iraqi insurgent Juba who videotaped his kills, the sniper remains a figure to be respected and feared. Striking unseen from incredibly long range, stopping their target with a single well-placed shot, a lone marksman has often turned the tide of a battle single-handedly, sometimes even halting entire armies in their tracks.

Many of history's most successful shooters have not only packed deadly aim, but possessed immense skill at blending in with their surroundings. From the harsh snow-strewn battlefields of the Finnish Winter War, to the jungles of Vietnam, these hidden hunters have left their own mark on history's battlefields.

01. CHRIS KYLE

The Texan-born Navy SEAL who became the most notorious sniper in US military history

Growing up, Kyle wanted to be a bronco rider, but a fall at a rodeo set him on the path to becoming a Navy SEAL. After graduating from the punishing Basic Underwater Demolition/SEAL (BUDs) selection course, he was posted to SEAL Team Three before later completing the three-month SEAL sniper course. His first kill came during the invasion of Iraq when an Iraqi woman attempted to throw an anti-tank grenade at US Marines. Kyle, watching from a rooftop hide, shot her before she could release the grenade. Many more followed, including a 1,460-metre shot in Fallujah.

The majority of Kyle's kills were during the Battle of Ramadi in 2005, when he dispatched a dozen insurgents in the first 12 hours. Kyle used a number of rifles but preferred the bolt action .300 Winchester Magnum Mk15, which accounted for most of his kills, and the McMillan TAC-338. He made his longest shot against an insurgent RPG gunner in Sadr City in 2008 using the TAC-338. Kyle's fame led to him being christened 'the Legend' by the SEALs and 'Shaitan Ar-Ramadi' or the 'Devil of Ramadi' by the insurgents.

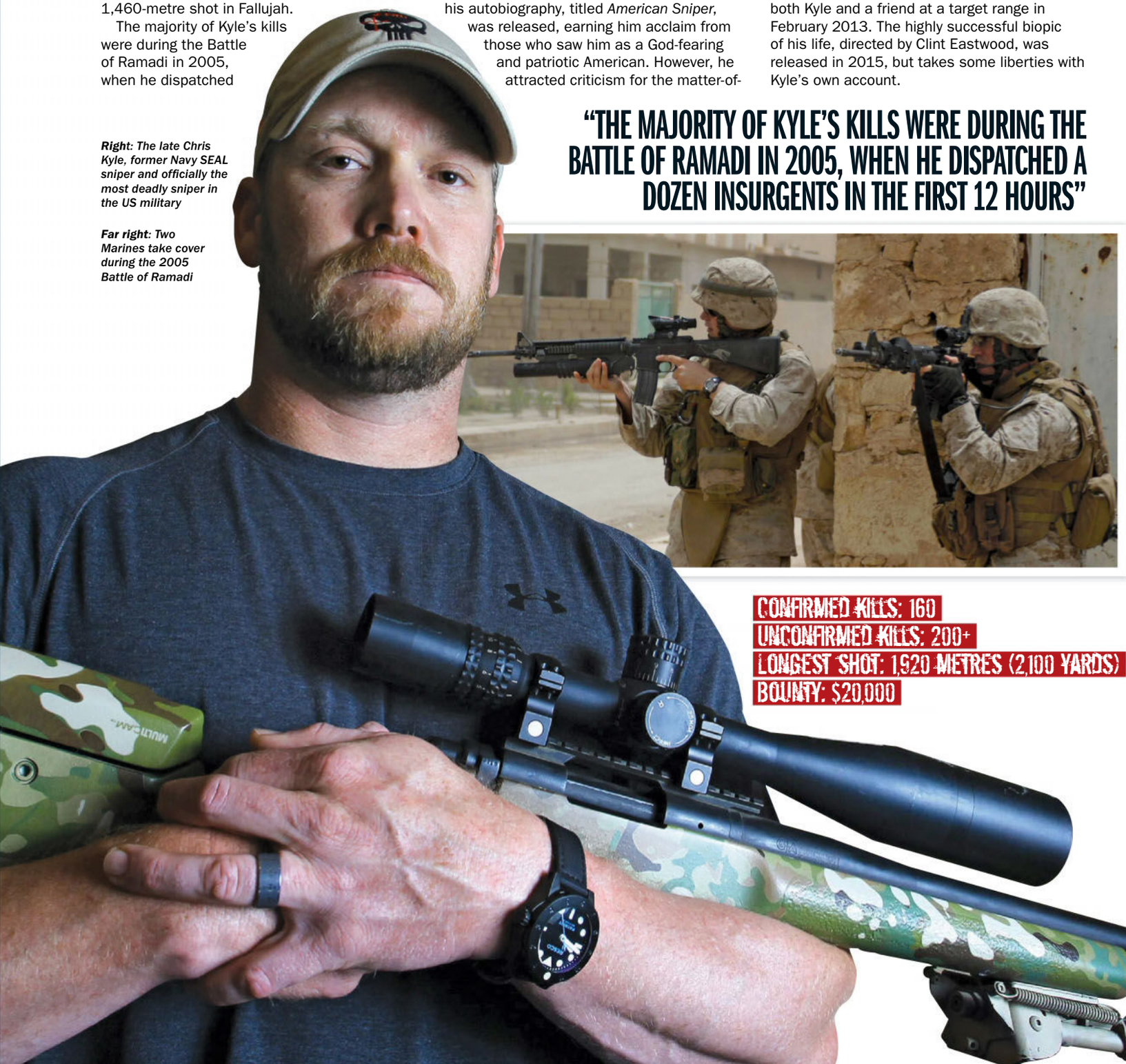
Kyle completed four combat tours of Iraq before retiring from the navy in 2009. In 2012, his autobiography, titled *American Sniper*, was released, earning him acclaim from those who saw him as a God-fearing and patriotic American. However, he attracted criticism for the matter-of-fact language he used regarding his kills, along with calling Iraqis "savages". Kyle defended himself by claiming that he was only referring to the insurgents.

Surprisingly, considering he experienced some of the heaviest fighting of the Iraq War, Kyle died not on the battlefield but back in his home state of Texas. After leaving the navy and writing his book, he established a shooting school and volunteered to help fellow veterans suffering from PTSD. One of these veterans, a 25-year-old former US Marine, shot and killed both Kyle and a friend at a target range in February 2013. The highly successful biopic of his life, directed by Clint Eastwood, was released in 2015, but takes some liberties with Kyle's own account.

***Right**: The late Chris Kyle, former Navy SEAL sniper and officially the most deadly sniper in the US military*

***Far right**: Two Marines take cover during the 2005 Battle of Ramadi*

"THE MAJORITY OF KYLE'S KILLS WERE DURING THE BATTLE OF RAMADI IN 2005, WHEN HE DISPATCHED A DOZEN INSURGENTS IN THE FIRST 12 HOURS"



CONFIRMED KILLS: 160
UNCONFIRMED KILLS: 200+
LONGEST SHOT: 1,920 METRES (2,100 YARDS)
BOUNTY: $20,000

02. CHUCK MAWHINNEY

The American Marine with the most kills in Vietnam

Charles 'Chuck' Mawhinney, a keen hunter, had intended on joining the navy, however, a recruiter promised to defer his start date until after the hunting season if he instead joined the Marine Corps. Mawhinney proved a superb shot and attended Scout Sniper School before shipping off to Vietnam in 1968.

Mawhinney typically deployed as part of a two-man team that would operate alongside an infantry unit, providing its eyes and ears and guarding the flanks. His most famous action was on the night of 14 February 1969, when an NVA platoon attempted to outflank Mawhinney's Marines. Instead, they ran into the American sniper, who made a record 16 kills, all headshots, in an estimated 30 seconds, blunting the attack.

For his 'Saint Valentine's Day Massacre', as the incident became known, Mawhinney used a semi-automatic 7.62x51mm M14 with a night-vision scope. Normally, however, he used a Marine-issue bolt-action M40, which can today be seen on display in the Marine Corps Museum. His longest-range shot was between 1,200 and 1,370 metres when he engaged four Viet Cong across a river, killing two.

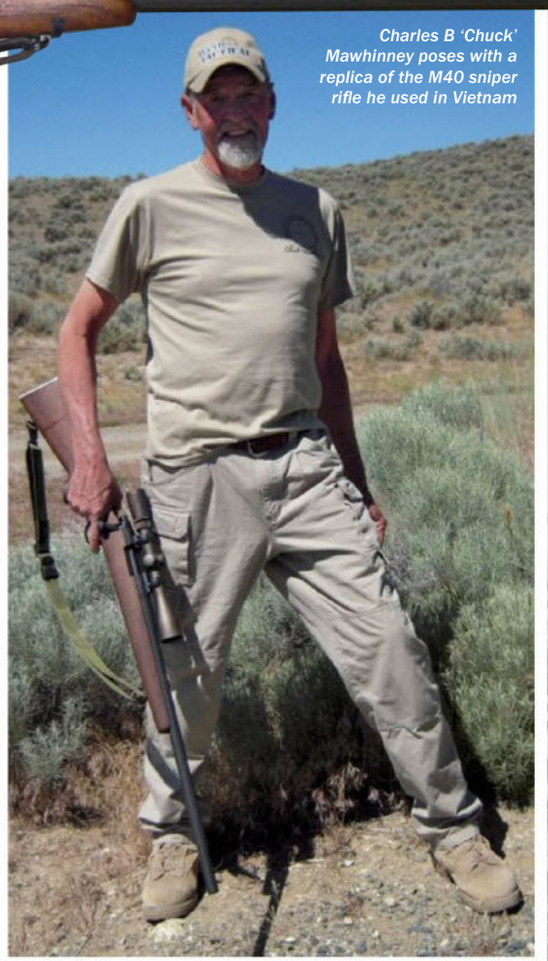
Mawhinney ended his war with a record 103 kills and 216 probable kills after a 13-month tour with two further six-month extensions that he volunteered to complete, as he believed his sniper skills saved American lives. He was eventually sent back to the USA with suspected 'combat stress' and served out his commitment as an instructor.

Mawhinney still holds the Marine Corps record for the most kills, although US Army sniper Adelbert Waldron held the overall record with 109 until Navy SEAL Chris Kyle's 160 kills. Perhaps not surprisingly, Mawhinney didn't mention his sniper service to anyone, including his wife. After leaving the Marine Corps in 1970 for a job with the Forestry Service, he was finally 'outed' by another Marine sniper's book.

"MAWHINNEY ENDED HIS WAR WITH A RECORD 103 KILLS AND 216 PROBABLE KILLS AFTER A 13-MONTH TOUR"

***Above:** Marine sniper Chuck Mawhinney's 7.62x51mm M40 rifle, which is on display at the Marine Corps Museum*

***Left:** A US Marine sniper watches for a target across paddy fields in Vietnam, circa 1968*



Charles B 'Chuck' Mawhinney poses with a replica of the M40 sniper rifle he used in Vietnam

CONFIRMED KILLS: 103
UNCONFIRMED KILLS: 216
LONGEST SHOT: 1,370 METRES (1,500 YARDS)

03. SIMO HAYHA

During the Winter War of 1939, Finnish sniper Simo Hayha, nicknamed 'White Death', killed more than 500 Soviets

For 100 days in the winter of 1939, the Soviets attempted to conquer Finland. With a tiny standing army, the Finns nonetheless used their natural affinity with the forests to bleed the Red Army dry, eventually forcing the behemoth to withdraw. Snipers were a major part of that effort, and the best was the diminutive Simo Hayha (he stood only five foot and three inches tall).

Hayha, like many World War II snipers, was a competitive shooter and hunter before the war. Stalking moose in the forests north of Helsinki, he understood the need for camouflage and stealth. Finnish snipers, known as 'cuckoos' to the Soviets as they often used concealed hides in trees to fire from, began to exact a heavy toll on the invaders.

Nicknamed 'White Death' by the Soviets thanks to his homemade snow camouflage suit, Hayha used his bolt-action 7.62x54mm M28-30 without any form of optical scope, instead relying on iron sights and his hunter's eye. Most of his shots were under several hundred metres anyway, as he silently stalked his prey through the snow. He believed any attachment to his rifle would simply add to his silhouette and increase his chance of exposure.

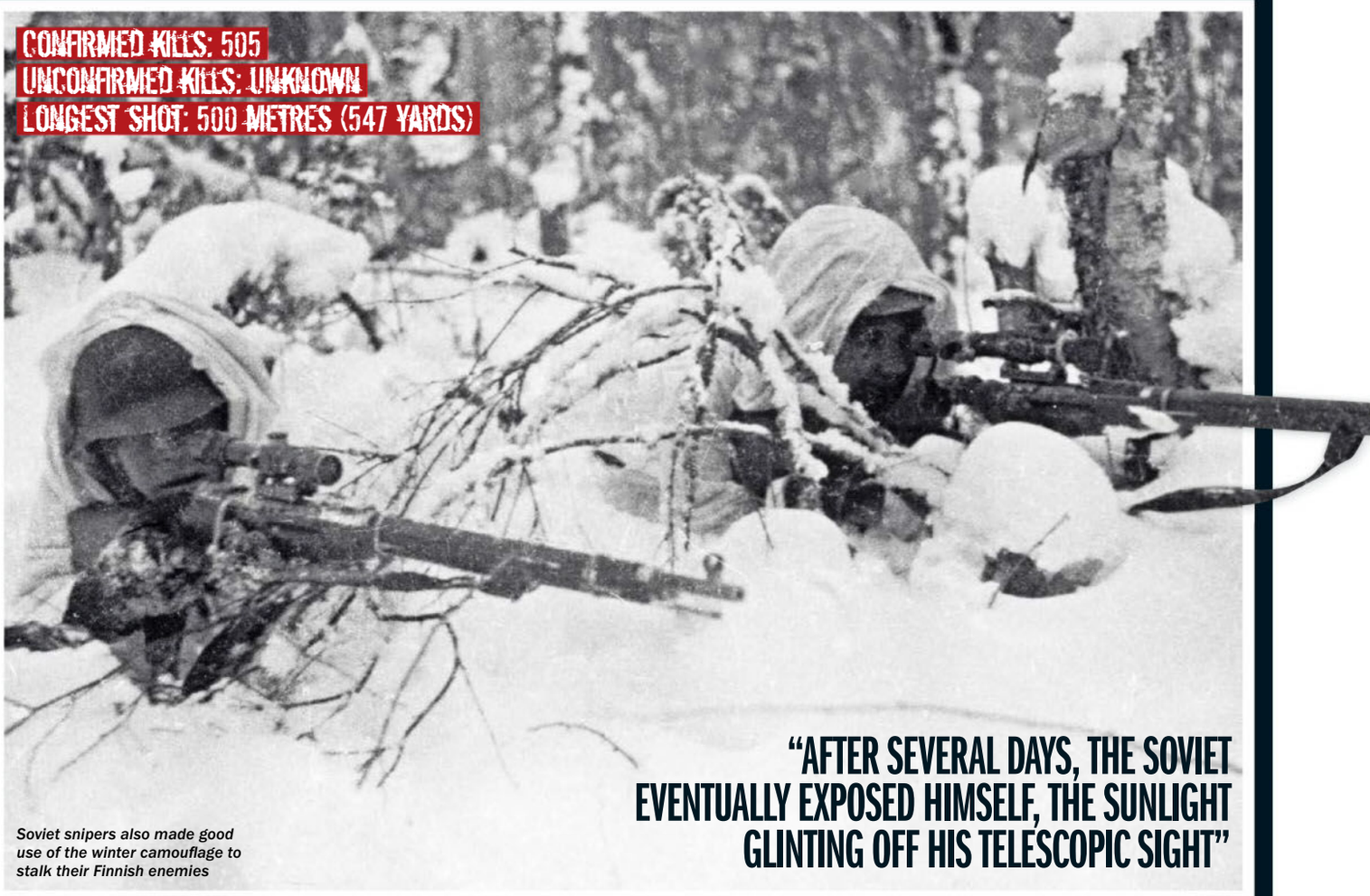
Hayha would often use skis to shadow a Red Army unit, firing one round from one direction and then disappearing to appear somewhere else. During one such mission, he and 30-odd Finns held off an estimated 4,000 Soviets in the Battle of Killer Hill. Hundreds of Russians were killed and only a handful of victorious Finns, Hayha among them, survived.

Hayha was killing, on average, five Soviet soldiers a day and he was famously dispatched to hunt down a Soviet sniper that had been causing trouble. The ever patient Hayha deployed into a snow hide in the area where the sniper had been operating and waited. After several days, the Soviet eventually exposed himself, the sunlight glinting off his telescopic sight. Hayha fired, killing the Soviet sniper with a single shot.

The Finnish sniper was almost killed by an enemy marksman. A Soviet sent to stalk him managed to spot him and shot the Finn in the face. He was rescued by his comrades but spent nine days in a coma with much of his left cheek shot away and his jaw broken. When he woke, the Winter War was over.

***Right:** White Death in his distinctive homemade camouflage smock. Hayha passed away in 2002 at the age of 96*

CONFIRMED KILLS: 505
UNCONFIRMED KILLS: UNKNOWN
LONGEST SHOT: 500 METRES (547 YARDS)



Soviet snipers also made good use of the winter camouflage to stalk their Finnish enemies

"AFTER SEVERAL DAYS, THE SOVIET EVENTUALLY EXPOSED HIMSELF, THE SUNLIGHT GLINTING OFF HIS TELESCOPIC SIGHT"

Nicholas Irving, aka 'the Reaper', competing in a US Army special operations sniper competition in 2009

***Above:** Ranger snipers from 1st Battalion, 75th Ranger regiment, practicing*

CONFIRMED KILLS: 33
LONGEST SHOT: 807 METRES (883 YARDS)

04. NICHOLAS IRVING

The marksmen of the US Army Rangers are the elite of the elite, and none more so than the Reaper

After initially wanting to join the Navy SEALs and being turned down because of his colour blindness, Nicholas Irving went on to join the US Army Rangers, serving for three and a half combat tours of Iraq and Afghanistan, eventually serving as a Sniper Team Leader. He claimed his first kill in Iraq, firing the .50-cal machine gun of a Stryker infantry carrier. Later in Afghanistan, all of his kills were made with his sniper rifle, his preferred semi-automatic 7.62x51mm SR-25 that he named 'Dirty Diana'.

Earning his own nickname, 'the Reaper', his longest range kill was against an insurgent machine gunner who was part of a Taliban ambush pinning down his Ranger platoon. His closest kill, on the other hand, was under ten metres away, when he was infamously involved in a vicious nine-hour ambush, surrounded by Taliban insurgents. Tasked with covertly infiltrating an area to confirm the presence of a high-value target, Irving and his spotter were accompanied by a four-man reconnaissance team. After confirming the target, they linked up with a Ranger assault force who breached into the target compound. Just as they did so, all hell broke loose.

Irving and his team were taking machine-gun and RPG fire from all sides. The assault force was also pinned down in heavy contact with the enemy. The Rangers held off the swarms of insurgents while frantically calling for close air support. When it arrived, the Rangers were told that due to the potential for collateral damage, no bombs could be dropped. A machine-gun team from the assault force managed to make it back to Irving and his team and suppressed the insurgents enough to allow them to withdraw to some marginally better cover.

Targeted by an enemy sniper, Irving and his partner managed to suppress him but were never sure of a kill. Eventually, the Rangers won the firefight but not without loss. Two of the reconnaissance team were seriously wounded and a member of the machine-gun team tragically died later from his wounds. At the end of the firefight, Irving was down to his last magazine and his partner had less than a dozen rounds left.

Irving heard on the grapevine that the insurgent sniper was apparently killed years later by a British Special Forces team. He retired from the army in 2013 as a master sniper and went on to establish his own shooting school and pen his autobiography, suitably entitled *The Reaper.*

"IN AFGHANISTAN, ALL OF HIS KILLS WERE MADE WITH HIS SNIPER RIFLE, HIS PREFERRED SEMI-AUTOMATIC 7.62X51MM SR-25 THAT HE NAMED 'DIRTY DIANA'"

05. LYUDMILA PAVLICHENKO

26-year-old Pavlichenko was one of the Red Army's most famous, and successful, female shooters

Ukrainian-born Pavlichenko volunteered for service in 1941 while she was studying history at university. The recruiter attempted to steer her towards a medical role but Pavlichenko was insistent that she would contribute more to the war effort as a sniper. After pointing to her sharpshooter badge won in competitive shooting before the war, Pavlichenko was granted her wish.

Within the Red Army there were as many as 2,000 female snipers, and while this was still a tiny percentage of the more than 800,000 who served, it was far more than in other contemporary armies that largely restricted females from combat roles. The Soviet forces widely employed female tank drivers and bomber pilots along with frontline infantry roles, alongside their male comrades.

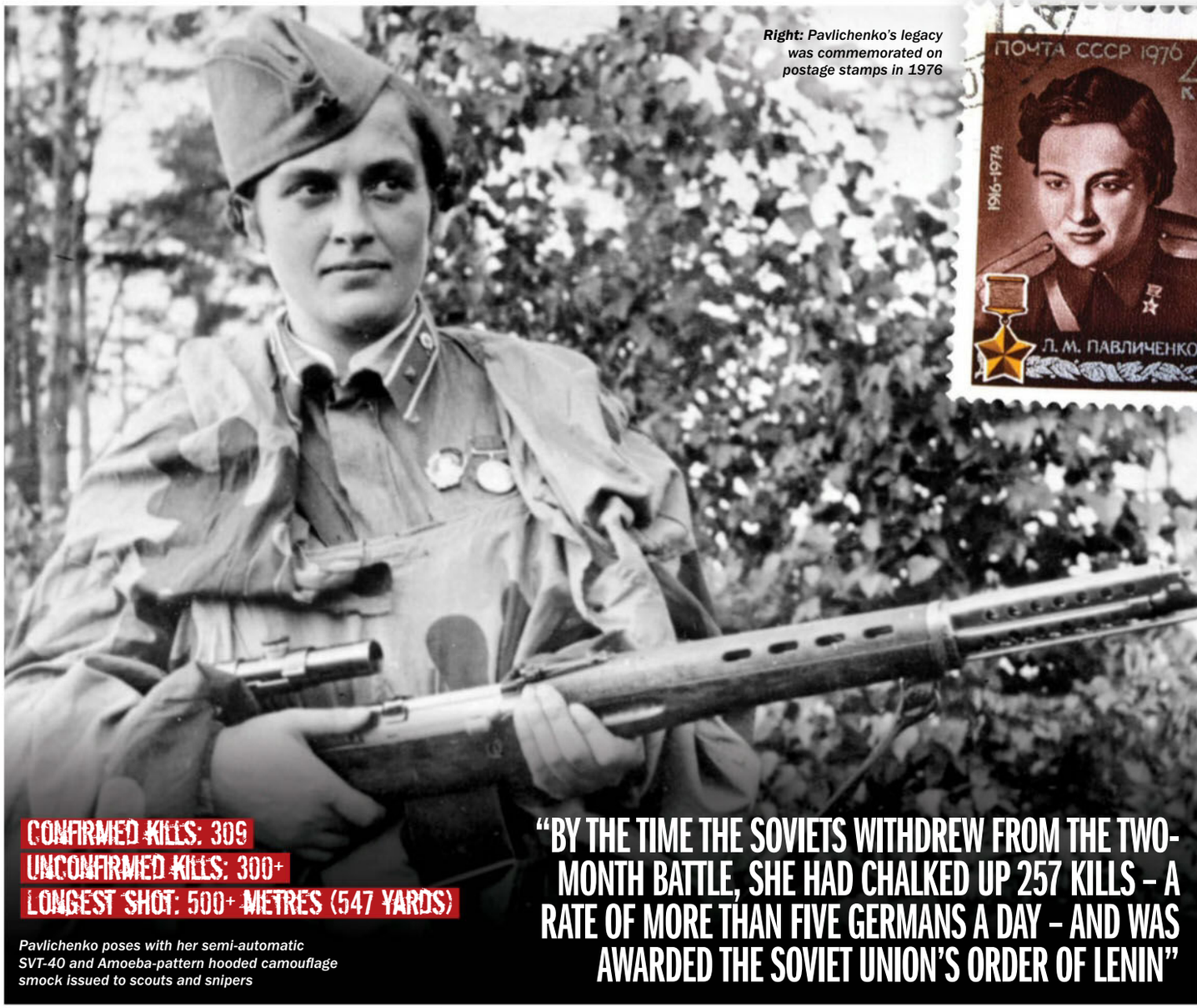
Pavlichenko killed her first German during the battle for Odessa, even though she admitted she found the act difficult – that is until a fellow soldier was shot dead near her. By the time the Soviets withdrew from the two-month battle, she had chalked up 257 kills – a rate of more than five Germans a day – and was awarded the Soviet Union's Order of Lenin.

Pavlichenko next deployed to the defence of Sevastopol, and by the middle of 1942, her kill tally had risen to 309 including 36 German snipers (a log book recovered from one sniper's body indicated he had killed more than 500 Soviets). She was also wounded several times.

Unusually, Pavlichenko apparently favoured the scoped semi-automatic 7.62x54mm SVT-40 when most of her contemporaries preferred the more accurate bolt-action Mosin Nagent.

After narrowly escaping Sevastopol before it was captured, the Red Army realised her potential as a propaganda tool and Pavlichenko was dispatched to the United States of America, becoming the first Soviet citizen to visit the White House. Such was her fame in the USA that she was the inspiration for a feature film and a folk song.

Upon her return to the Soviet Union, her efforts were recognised with the award of the Hero of the Soviet Union. Afterwards, she became a sniping instructor and something of a national hero. Many of her fellow female snipers fell during the war, with only a quarter surviving until 1945. Pavlichenko was promoted to major and served in the military for the remainder of her career. She was immortalised on a postage stamp in 1976, two years after her death.



***Right:** Pavlichenko's legacy was commemorated on postage stamps in 1976*

CONFIRMED KILLS: 309
UNCONFIRMED KILLS: 300+
LONGEST SHOT: 500+ METRES (547 YARDS)

Pavlichenko poses with her semi-automatic SVT-40 and Amoeba-pattern hooded camouflage smock issued to scouts and snipers

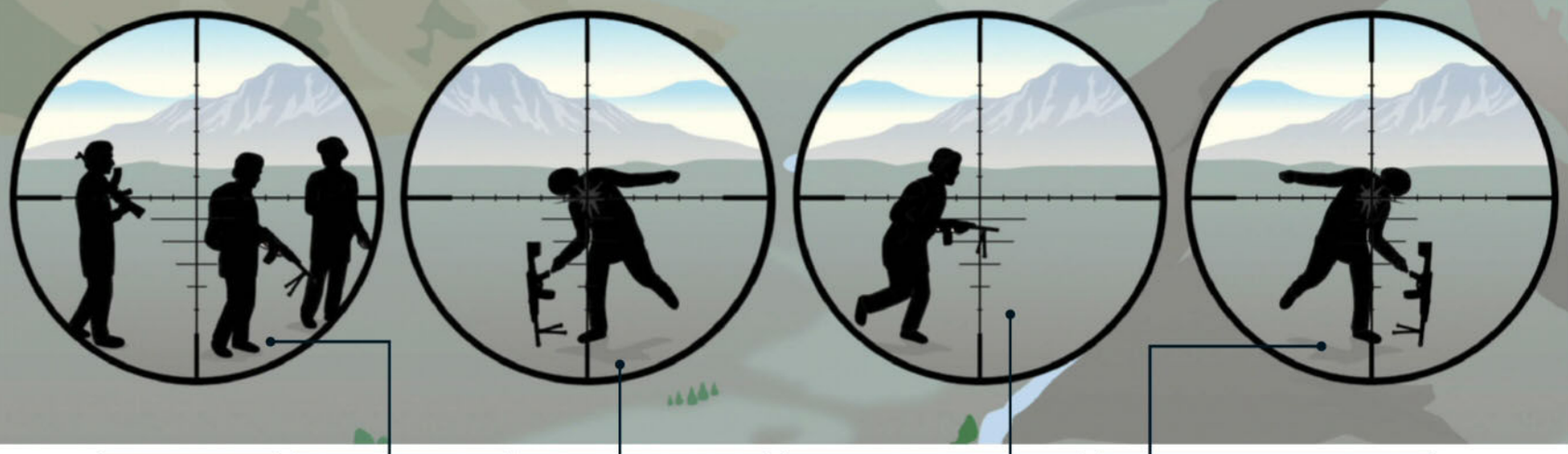
"BY THE TIME THE SOVIETS WITHDREW FROM THE TWO-MONTH BATTLE, SHE HAD CHALKED UP 257 KILLS – A RATE OF MORE THAN FIVE GERMANS A DAY – AND WAS AWARDED THE SOVIET UNION'S ORDER OF LENIN"

LONG-RANGE RECORD IN AFGHANISTAN

British Army Corporal Craig Harrison broke the world record held by Rob Furlong with a 2,475-metre shot

Corporal of Horse Craig Harrison, a British Army sniper of the Household Cavalry, served in the Balkans and twice in Iraq and Afghanistan. It was during his last fateful tour in 2009, deployed to restive Musa Qala in Helmand Province, that Harrison made his famous shot.

Harrison's sniper team was deployed to overwatch a British patrol, which was soon ambushed. After firing warning shots at a Taliban spotter at 3,000 metres (double the effective range of his rifle), he spotted a new threat. An insurgent PKM machine gun had moved into position on a nearby hill and was bracketing the British patrol with fire.



1. GETTING THE RANGE
Harrison estimates the range to the hillside to be in excess of 2,000 metres. Checking the wind, he is pleased to see that there is none. He adjusts his scope for the trajectory of the bullet and the rotation of the Earth.

2. THE RANGING SHOTS
Breathing out, Harrison squeezes the rifle's trigger, sending the first .338 Lapua Magnum heading downrange towards the insurgent machine gunner. Six seconds later, the round impacts. A miss. Harrison will later report that it took him nine shots to range the target.

3. FIRST TARGET DOWN
The insurgents do not know where the shots are being fired from. Harrison's shot hits dead on and the fighter holding the PKM crumples to the ground.

4. A NEAR MISS
Rapidly working the bolt, Harrison chambers another round and fires again, six seconds later, a miss. One of the other insurgents grabs the PKM and starts to move, racing for cover from the deadly fire.

5. THE FINAL SHOT
Harrison knows he has to make the shot or the Taliban will escape. He gently squeezes the trigger sending his fourth shot towards the target. Harrison and his spotter watch as the round hits the second insurgent and he collapses from view.

L115A3 RIFLE

The reliable accuracy of this rifle allowed Corporal Harrison to make his record-breaking shot

MANUFACTURE: UNITED KINGDOM
FIRST YEAR OF SERVICE: 2007
CALIBRE: .338 LAPUA MAGNUM
RANGE: 1600 METRES
USERS: BRITISH ARMY AND ROYAL MARINES

BARREL
The match grade barrel is fluted to reduce heat build up and equipped with a sound suppressor to conceal the sniper's location.

SCOPE
The Schmidt and Bender PMII variable power scope magnifies the target up to 25 times and can be used with a clip-on night sight.

BULLET
The 300-grain boat tail .338 Lapua Magnum round is designed to maintain stability over long distances and is accurate to beyond 2,000 metres.

STOCK
The desert-coloured stock is designed to be folded when carried strapped to the sniper's back. The cheek-piece, stock height and length are fully adjustable.

06. CARLOS HATHCOCK

For more than 30 years, US Marine Gunnery Sergeant Carlos Hathcock held the record for the world's longest distance sniper kill

A top competitive rifleman and member of the Marine Corps Rifle Team, Carlos Hathcock deployed to Vietnam for his first tour in 1966 as a military policeman. Soon he was made an instructor at the first Marine sniper school, which had been operating since World War II.

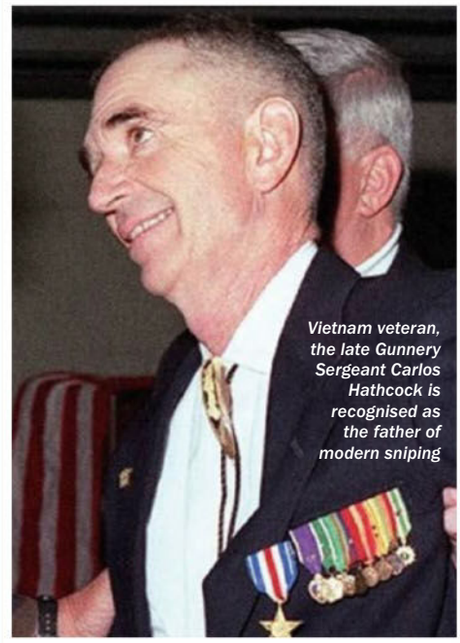
Hathcock was not content with instructing young snipers and instead deployed on dozens of operations, including the assassination of a North Vietnamese general. Camouflaged in a Ghillie suit, Hathcock slowly stalked his prey for 1,500 metres through jungle guarded by NVA patrols. At one point, an NVA soldier almost stepped on him, but he waited until the conditions were optimal and fired a single round, killing the general.

The North Vietnamese organised a cell of their own snipers with the express purpose of hunting Hathcock down. They nicknamed him 'White Feather' because he habitually wore one in his boonie hat. Hathcock killed one of these snipers in a tense duel that saw him famously shoot his enemy through his own telescopic scope as he was lining up a shot to kill him.

On another operation, Hathcock and his spotter deployed into a camouflaged hide to watch a trail well known for troop movements. Sure enough, an NVA company soon appeared moving cautiously along the trail. Hathcock and his spotter picked their targets and fired simultaneously, killing two NVA officers. The Vietnamese soldiers threw themselves into what cover they could find. Several who tried to run were killed.

The remaining NVA decided to wait until darkness fell before attempting their escape. Hathcock requested illumination flares to be fired and he and his spotter caught seven more. The NVA ended up being pinned down for four days, and every time one exposed himself, he was killed. Eventually, the Marines, low on water and ammunition, withdrew as silently as they had arrived.

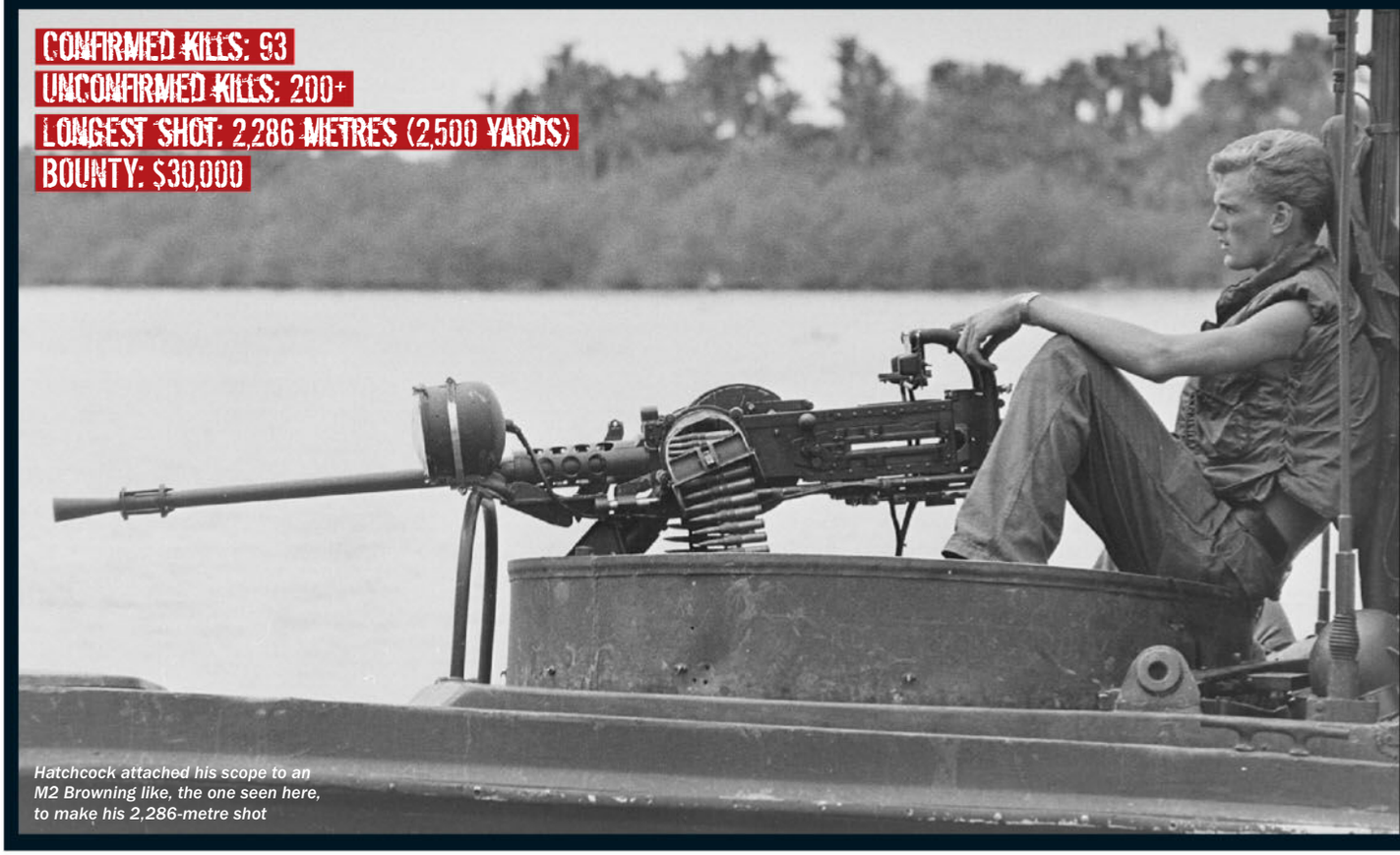
Hathcock's greatest feat was still yet to come. Realising that his .30-06 Winchester Model 70 did not have the range to target one troublesome Vietnamese forward observer, Hathcock looked to a .50-cal M2 Browning heavy machine gun. Knowing that the bullet would reach at least 2,000 metres, he added the scope from his rifle to the machine gun and made his world record 2,286-metre shot.



Vietnam veteran, the late Gunnery Sergeant Carlos Hathcock is recognised as the father of modern sniping

"HATHCOCK KILLED ONE OF THESE SNIPERS IN A TENSE DUEL THAT SAW HIM FAMOUSLY SHOOT HIS ENEMY THROUGH HIS OWN TELESCOPIC SCOPE AS HE WAS LINING UP A SHOT"

CONFIRMED KILLS: 93
UNCONFIRMED KILLS: 200+
LONGEST SHOT: 2,286 METRES (2,500 YARDS)
BOUNTY: $30,000



Hatchcock attached his scope to an M2 Browning like, the one seen here, to make his 2,286-metre shot

07. VASILY ZAYTSEV

The most famous Soviet sniper immortalised in 'Enemy At The Gates'

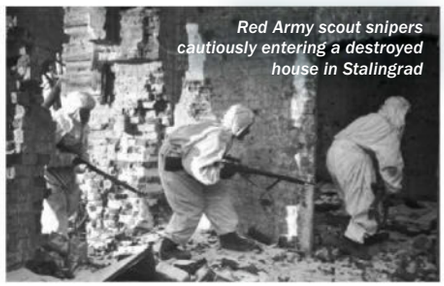
Zaytsev originally joined the Soviet navy as an infantryman but was transferred to the Red Army in September 1942 after his pre-war experience as a hunter in the inhospitable Urals became known. Sent to the hellhole of Stalingrad, he immediately killed his first 30 Germans with his standard-issue Mosin Nagant, winning the Order of Lenin.

Recognising his skill, the 27-year-old was equipped with a scoped Mosin Nagant M91/30 and began to stalk the ruined city, hunting Germans. By the end of 1942, Zaytsev had killed 225 enemy. His most famous mission occurred after the Red Army began suffering casualties from a newly arrived German marksman, allegedly an SS sniper instructor dispatched from Berlin. So began an epic stalk that was recounted in Zaytsev's autobiography and the film and book *Enemy At The Gates*.

The German sniper was cautious and an even match for Zaytsev. Eventually, after stalking each other for several days through the rubble, the German, named as Major Erwin Konig, made a mistake and paid for it with his life. Sunshine glinted off the German's scope and Zaytsev won the duel with a single shot.

Some controversy surrounds the account of the duel with a number of historians questioning whether or not it actually occurred, or at least as Zaytsev relates it (his was apparently the basis for the account in the original *Enemy At The Gates* book). No record of a Major Konig has ever been found, for instance. Whether all of the exact details are true or not, Zaytsev certainly went on to kill at least ten German snipers.

The young soldier was eventually wounded and forced to retire after losing much of the sight from his right eye, however, he then became an instructor and something of a folk hero with some 400 kills to his name.



Red Army scout snipers cautiously entering a destroyed house in Stalingrad

"SENT TO THE HELLHOLE OF STALINGRAD, HE IMMEDIATELY KILLED HIS FIRST 30 GERMANS WITH HIS STANDARD-ISSUE MOSIN NAGANT, WINNING THE ORDER OF LENIN"

***Right:** The deadly 7.92x57mm Mauser 98K sniper rifle used in the duel against Vasily Zaytsev in Stalingrad*

***Below:** Zaytsev (left) in a staged propaganda shot wearing Soviet-issue snow suits and carrying his Mosin Nagant M91/30 sniper rifle*

CONFIRMED KILLS: 242
UNCONFIRMED KILLS: 150

08. IVAN SIDORENKO

Among the most prolific snipers in history

Red Army Captain Ivan Sidorenko began the war in 1941 firing mortars, but he soon liberated a rifle and began to teach himself the dark art of sniping. His talent was recognised and rewarded with an appointment to train other snipers at a divisional level school. Soon his reputation reached even German ears and a number of enemy snipers were dispatched to deal with the young major, but all failed.

Instructing was not enough for Sidorenko and he regularly visited the front to keep his shooting eye in – he was rewarded with no less than three wounds. He once famously stopped a German tank with several rounds of armour-piercing incendiary from his Mosin Nagant. Eventually, in Estonia, Sidorenko was wounded badly enough to end his sniping career, although he continued to instruct and was credited with training more than 250 Red Army snipers.

Sidorenko earned more than 500 confirmed kills, making him the most prolific sniper in history (although critics argue that Finn sniper Simo Hayha killed more, but many of his kills were with a sub machine gun) and awarded the Hero of the Soviet Union. After the war, Sidorenko worked for a coal mine in the Urals before passing way in 1987.

Ivan Sidorenko of the Red Army is regarded as the most effective sniper in history with more than 500 kills to his name

"HE WAS CREDITED WITH MORE THAN 500 CONFIRMED KILLS, MAKING SIDORENKO THE MOST PROLIFIC SNIPER IN HISTORY"

09. WILLIAM 'BILLY' SING

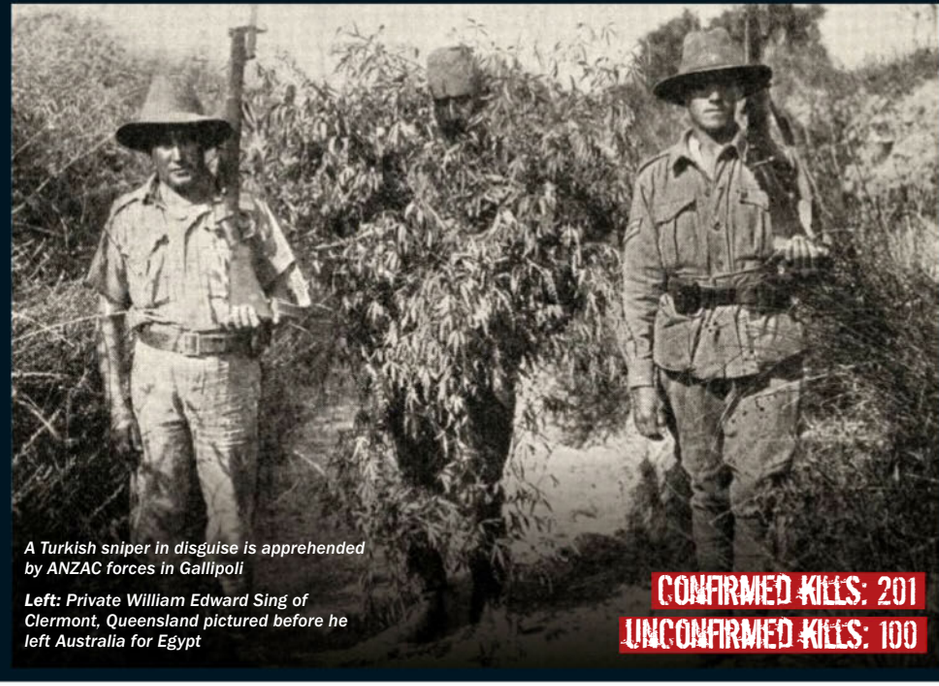
The first shooter to engage in a deadly long-range duel

Of mixed Chinese and English heritage, Billy Sing grew up in rural Queensland, Australia, shooting kangaroos to earn a living. He was also a competitive rifle shooter, a trait many early snipers share. When war was declared in 1914, Sing volunteered and was soon sent to Egypt. The sniper deployed to the Gallipoli peninsula with Australian forces and was engaged in the bloody stalemate with Turkish forces firing down upon the ANZACs from the ridges above.

Sniping had yet to be formally established in the Australian Army and it wouldn't be until General Birdwood, in charge of all ANZAC forces, organised them into two-man teams with one spotting for his partner. Sing's spotter described him as "a picturesque little man-killer" and he soon received nicknames 'the Murderer' and 'the Assassin'. Sing was particularly effective conducting what today would be called counter-sniper missions, working with a spotter who searched for enemy gunners with a field periscope. His most famous kill was 'Abdul the Terrible', a German-trained Turkish sniper who had been brought in to kill Sing.

The Turkish sniper watched and waited for Sing to reveal himself from a concealed hide. Eventually, Sing was spotted but the young Australian saw his adversary at the same time. Sing was the faster shot and managed to hit the Turk sniper in the head, adding another to his tally.

He received the Distinguished Conspicuous Medal for "… gallantry from May to September 1915 at Anzac as a sniper. His courage and skill were most marked and he was responsible for a very large number of casualties among the enemy, no risk being too great for him to take." In fact, Sing was credited with 201 confirmed kills along with at least another 100 likely according to those who served with him.



A Turkish sniper in disguise is apprehended by ANZAC forces in Gallipoli

***Left:** Private William Edward Sing of Clermont, Queensland pictured before he left Australia for Egypt*

10. FRANCIS PEGAHMAGABOW

Canada's top marksman of the Great War and the most decorated First Nation soldier in history

Corporal Francis 'Peggy' Pegahmagabow was a Canadian First Nation soldier who became known as Canada's first and most effective sniper. A former fireman, Pegahmagabow joined up in September 1914 and deployed to France in 1915, fighting in some of the war's bloodiest battles on the Somme and Passchendaele. He survived the war, even though he suffered a gunshot wound and was almost buried by an exploding artillery shell.

He displayed a natural aptitude for scouting and sniping, and was recognised for his skills as a dispatch runner, able to negotiate the blasted terrain with seeming ease. He famously evaded fearsome enemy fire to resupply his platoon with much needed ammunition and once took over the platoon when his commander was wounded. He also had a natural aptitude with the roundly disdained Canadian Ross rifle.

***Left:** Corporal Francis 'Peggy' Pegahmagabow killed 378 enemy and captured more than 300*

During the course of the war, Pegahmagabow racked up some 378 kills with his rifle and personally captured more than 300 Germans, a record for both Canadian and Allied forces. Another First Nation sniper, Henry Norwest, killed 115 Germans before he was killed in action. Pegahmagabow, however, survived to become the most decorated First Nation soldier in history.

"DURING THE COURSE OF THE WAR, PEGAHMAGABOW RACKED UP SOME 378 KILLS WITH HIS RIFLE AND PERSONALLY CAPTURED MORE THAN 300 GERMANS, A RECORD FOR BOTH CANADIAN AND ALLIED FORCES"

Camouflaged snipers are instructed by officers during World War I

RESCUE OF CAPTAIN PHILLIPS

Navy SEAL snipers shoot three pirates at night, from a boat, to save the hostage

The container ship Maersk Alabama was hijacked by Somali pirates in April 2009. The ship's captain, Richard Phillips, was taken hostage and after unexpected resistance from Maersk Alabama's crew, the four pirates, armed with AK-47s, took to the seas with their captive in a lifeboat. The US Navy responded with a warship, the USS Bainbridge, and a rescue team from DEVGRU (formerly SEAL Team Six). As negotiations continued and inclement weather moved in, the Navy persuaded the hijackers to allow their life boat to be towed behind Bainbridge. One pirate was in need of medical treatment and was transferred to Bainbridge, while the others were adamant that only a $2 million ransom would secure Phillips's release.

1. SEAL INFILTRATION
The SEAL Team Six assault force parachutes into the sea near the Bainbridge with all of their weapons and kit, including a Somali American interpreter who has never parachuted before.

4. RANGING THE SHOT
The range is only 25 metres, but the motion of the boats and the need for simultaneous headshots using night vision complicates the shot.

2. SNIPERS DEPLOY
The SEAL snipers deploy onto the rear deck of the Bainbridge and settle in for a long wait. Other SEALs stand by to launch an assault on the life boat.

6. THE RESCUE
Two SEALs climb along the tow line and shoot the downed pirates again to make sure they're no longer a threat before securing Captain Phillips and transferring him to safety.

5. THE KILL SHOTS
Once all three snipers have clear shots, and upon their team leader's command, all three fire, delivering headshots to each of the pirates who collapse around the hostage.

3. THE TRIGGER
The pirates become ever more restless and eventually one fires his AK-47 near Phillips. President Obama has personally authorised the SEALs to act in order to save the hostage.

HECKLER AND KOCH HK416

This versatile rifle was the unlikely weapon the SEALs used to take their simultaneous headshots

MANUFACTURER: HECKLER AND KOCH, GERMANY
FIRST YEAR OF SERVICE: 2004
CALIBRE: 5.56x45MM
RANGE: 400 METRES
USERS: DELTA FORCE, SEAL TEAM SIX, POLISH GROM AND FRENCH COS

SCOPE
The Nightforce scope offers variable magnification between 2.5 and ten power. It was used with a clip-on thermal night sight.

BARREL
The match grade 14.5-inch barrel is fitted with an AAC sound suppressor that deadens the report of the rifle.

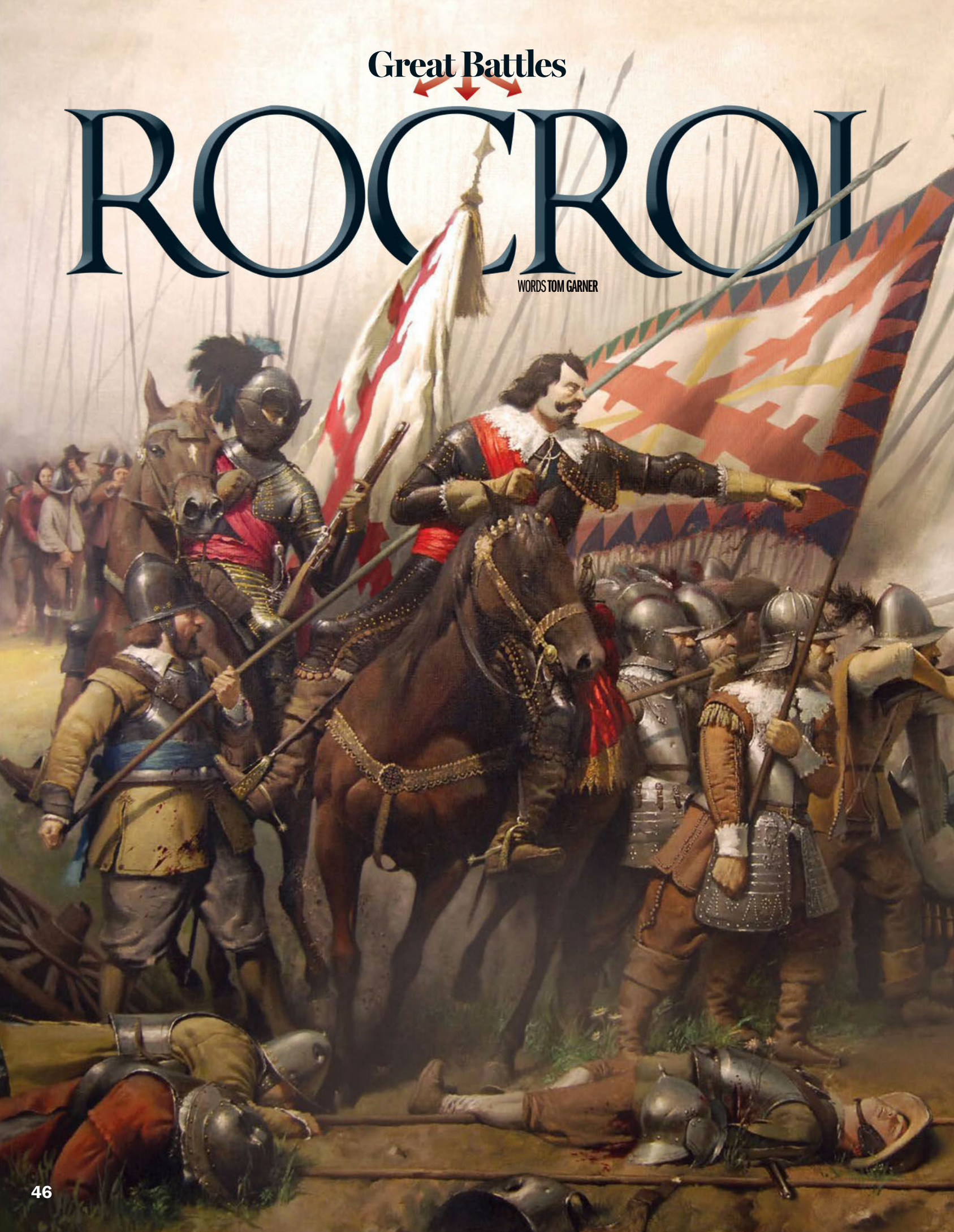
BULLET
The 5.56x45mm 70-grain Barnes TSX Optimized Brown Tip is designed to shed all of its energy on impact with the target. It is allegedly the round that killed Osama bin Laden.

STOCK
The shoulder stock can be adjusted to suit the individual operator while a Harris detachable bipod steadies the rifle for longer range shooting.

Images: Alamy; Corbis; Getty

ROCROI

WORDS TOM GARNER



OPPOSING FORCES

SPAIN		FRANCE
LEADERS		LEADERS
Don Francisco de Melo	VS	Louis duc d'Enghien
INFANTRY 19,000		INFANTRY 17,000
CAVALRY 8,000		LIGHT CAVALRY 6,000
GUNS 18		GUNS 14

The Spanish tercios fought a desperate last stand against French cavalry and artillery

"IT IS ESTIMATED THAT PERHAPS 8 MILLION PEOPLE PERISHED AS A DIRECT RESULT OF THE WAR, EITHER THOUGH MILITARY ACTION, VIOLENT PLUNDERING OR OUTBREAKS OF DISEASES"

FRANCE, 19 MAY 1643

Spanish and French armies clash in the Ardennes forest, in a decisive contest that will change the course of the Thirty Years' War and the balance of power in Europe

The Thirty Years' War was one of the most devastating conflicts in European history, an apocalypse only comparable to the later Napoleonic and world wars. Some parts of what is now Germany lost two-thirds of its population and it is estimated that perhaps 8 million people perished as a direct result of the war, either though military action, violent plundering or outbreaks of diseases that accompanied huge travelling armies. At the heart of this struggle was the fight between France and Spain – the Battle of Rocroi was the climax of this ultimate duel of nations.

Spain had been involved in the war almost from its inception. It was the pre-eminent power on the continent and, in addition to its Iberian heartlands, held vast territories including northern Italy, the Franche-Comté area in what is now eastern France and the Spanish Netherlands in Belgium and Luxembourg. To get to these territories, supplies and soldiers marched along 'The Spanish Road', which snaked north from Italy until it reached the Spanish Netherlands.

The extensive logistics involved were aided by the fact that most of the road passed through territory held by the powerful Habsburg dynasty. In the 17th century, most of Europe was ruled by the Habsburgs, who were divided into two branches. In 1643, one branch was ruled by Ferdinand III, who was the Holy Roman Emperor and ruler of Hungary, Bohemia, Croatia and Austria. The other was led by Philip IV of Spain, who also ruled Portugal and the Spanish Netherlands. His additional titles included the Duchy of Burgundy, sovereign of several Italian states and ruler of a vast colonial empire. Habsburg territory surrounded the land borders of France, making the French extremely nervous about the security of their frontiers. Even at sea they could not feel secure, as Spain was also the dominant naval power, operating separate fleets in the Atlantic and Mediterranean.

Consequently, the French developed a siege mentality and began using diplomatic means to undermine Habsburg supremacy. Cardinal Richelieu, the powerful chief minister of Louis XIII, led these efforts in the early 1630s, and in 1635 he declared war on Spain. At first events did not go well for the French as the Spanish invaded and ravaged northern France. In 1636, even Paris was threatened and French intervention in Italy failed.

At the end of 1642, Richelieu died and was followed to the grave six months later by Louis XIII, who was succeeded by his four-year-old son Louis XIV. With a child on the throne and its most capable minister dead, France was caught in a moment of weakness that Spain saw the opportunity to exploit. Within five days of Louis XIII's death, a large army invaded northern France from the Spanish Netherlands. The board was set for a historic clash of arms.

In May 1643, Spain invaded France with an army of 26,000 men and the intention of marching on Paris. Their plan was to approach from the north east through the Ardennes forest. Blocking their path was the fortress town of Rocroi. Despite being garrisoned by only 4-500 soldiers, Rocroi's location was strategically important. It lay on the border with the Spanish Netherlands and was surrounded by the dense forests of the Ardennes. The town also blocked the main road to Paris and would have to be overcome for a successful march on the capital. Opposing Spain's army was the town's garrison and the Army of Picardy, numbering some 22,000 men. The French were outnumbered; to make things worse, their general was by no means a veteran.

The commanders that faced one another at Rocroi could not have been more different both in character and experience. Aged 46, Spanish General Don Francisco de Melo was an accomplished politician and ambassador who had become the governor of Flanders in 1641. More importantly, he had already won a battle against the French in 1642 at Honnecourt, where the French Army of Champagne had been almost annihilated by a force twice its size.

"WITH A CHILD ON THE THRONE AND ITS MOST CAPABLE MINISTER DEAD, FRANCE WAS CAUGHT IN A MOMENT OF WEAKNESS THAT SPAIN SAW THE OPPORTUNITY TO EXPLOIT"

The battle at Honnecourt had left northern France exposed to the Spanish army, however, de Melo cautiously chose not to exploit this victory in 1642. He believed he could successfully consolidate his triumph in preparation for the following campaign, when he would have more fresh troops. In 1643, de Melo would have been more than confident of his chances of success.

Facing de Melo was Louis de Bourbon, Duc d'Enghien. At the alarmingly young age of 21, Enghien was a senior member of the French royal family but an untried general. He was a member of the Condé branch of the House of Bourbon and cousin to Louis XIII and XIV. As befitting his high rank, Enghien had received a thorough education, but his experience of military affairs was quite limited. Before 1643, he had only seen action at the sieges of Arras and Perpignan, neither of which he had been in command for. Rocroi would not just be his first battle, but also his first command as a general. It was a tough assignment, as he would be facing the finest fighting force of the previous 100 years.

Having approached Rocroi, de Melo immediately surrounded the fortress – he did not want the town to remain un-captured in his rear while he continued to Paris. While this was happening, couriers were hurriedly sent to Enghien's nearby army. The French general rapidly marched to relieve Rocroi and fend off the Spanish, but while he was moving, he received word there were 6,000 Spanish reinforcements marching to Rocroi to supplement de Melo's numbers. The situation, already dangerous, was now turning critical. Enghien knew he had to defeat de Melo before the reinforcements could tip the balance.

To approach Rocroi, there was only one access road, and it ran through a deep defile in a ridge south of the town. Luckily for the French, the road was unguarded and Enghien safely passed through, drawing up his army on a ridge facing the rear of the Spanish force. Not guarding this southern road to Rocroi was a mistake the Spanish would come to regret.

The area immediately around Rocroi was a small clearing in the Ardennes forest. When de Melo saw the French deploying behind him, he reordered his forces on a facing ridge next to the fortress, with a stream in marshland positioned between the two armies. Night was falling, but nonetheless a French cavalry unit attempted to relieve the town. This failed and the cavalry were repulsed. Both armies now slept in their positions, preparing for the start of the battle to come.

Before dawn on 19 May, the two armies lined up in very similar positions to the previous day.

The Duc d'Enghien orders his troops to stop fighting as the Spanish offer surrender

THE TERCIOS

HOW THESE MULTI-ROLE UNITS CAME TO DOMINATE EARLY MODERN BATTLEFIELDS

Above: *The tercios were the elite units of the Spanish infantry and were famed throughout Europe for their fighting prowess*

Right: *Pikemen were an essential component of the Spanish tercio. This particular soldier is holding a halberd*

For decades Spain's tercios were the most fearsome, elite military unit in Early Modern Europe. The tercio had developed out of a combination of improvements in gunpowder technology and the rise of the infantry square during the 15th century. Swiss pikemen had become famous for forming highly disciplined squares and successfully defeating heavy cavalry charges led by the Duke of Burgundy. The Spanish, learning from their own military campaigns in Italy, took this method one step further by deploying firepower units, such as the arquebus, in between the pikemen. This dramatically increased the strength and flexibility of the square. There was an equal distribution of pikemen and gunmen and they fought together in the same tactical formation under strict discipline.

Each tercio numbered 3,000 men and was formed of 12 companies of 250 men – the same size as a modern brigade. Within each company the pikemen formed a central block ten ranks deep, while an equal number of arquebusiers operated on the flanks. The pikemen needed depth to form a solid formation that could resist cavalry attacks – this became commonly known as the 'push of pike'. At the same time, the arquebusiers were deployed in equal depth in order to maximise firepower. The volleys of gunfire were controlled with great discipline and efficiency, as arquebusiers were formed up in two lines and trained not to fire without orders. The practice was for the front rank to deliver a single mass volley, then retire to the rear of the square to reload. The second rank would then step forward, aim, fire on order and also retire so that the front rank could fire again. These tactics meant that a Spanish tercio could deliver continuous volleys against an advancing formation. To maintain the high quality of a tercio's performance, care was taken to keep a high number of veterans in the units to encourage the younger soldiers. This professionalism made the tercios the best infantry in Europe and they gained a reputation for invincibility in major battles – it was a reputation that would be ultimately tested at Rocroi.

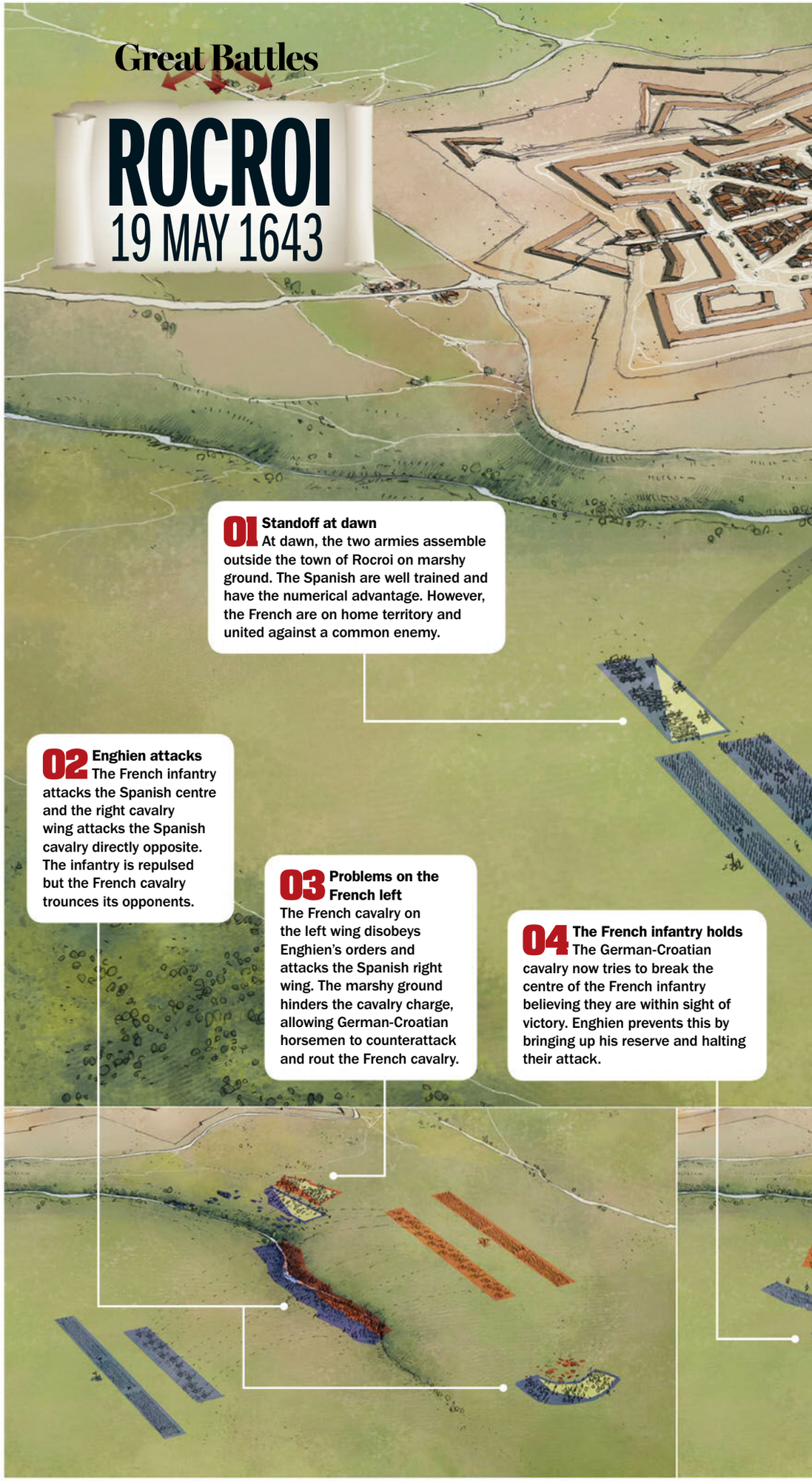
Both sides placed their cavalry on the flanks and the infantry, which was arranged in two lines, was placed in the centre. Finally, each army's artillery was drawn up in front of the infantry. There were also reserves: the French could call upon two squadrons of cavalry, three battalions of infantry and six companies of gendarmes. The latter was a relatively new type of unit that consisted of lightly armoured troops armed with pistols and swords. The Spanish had two squadrons of cavalry in reserve in addition to the 6,000 reinforcements that were on their way.

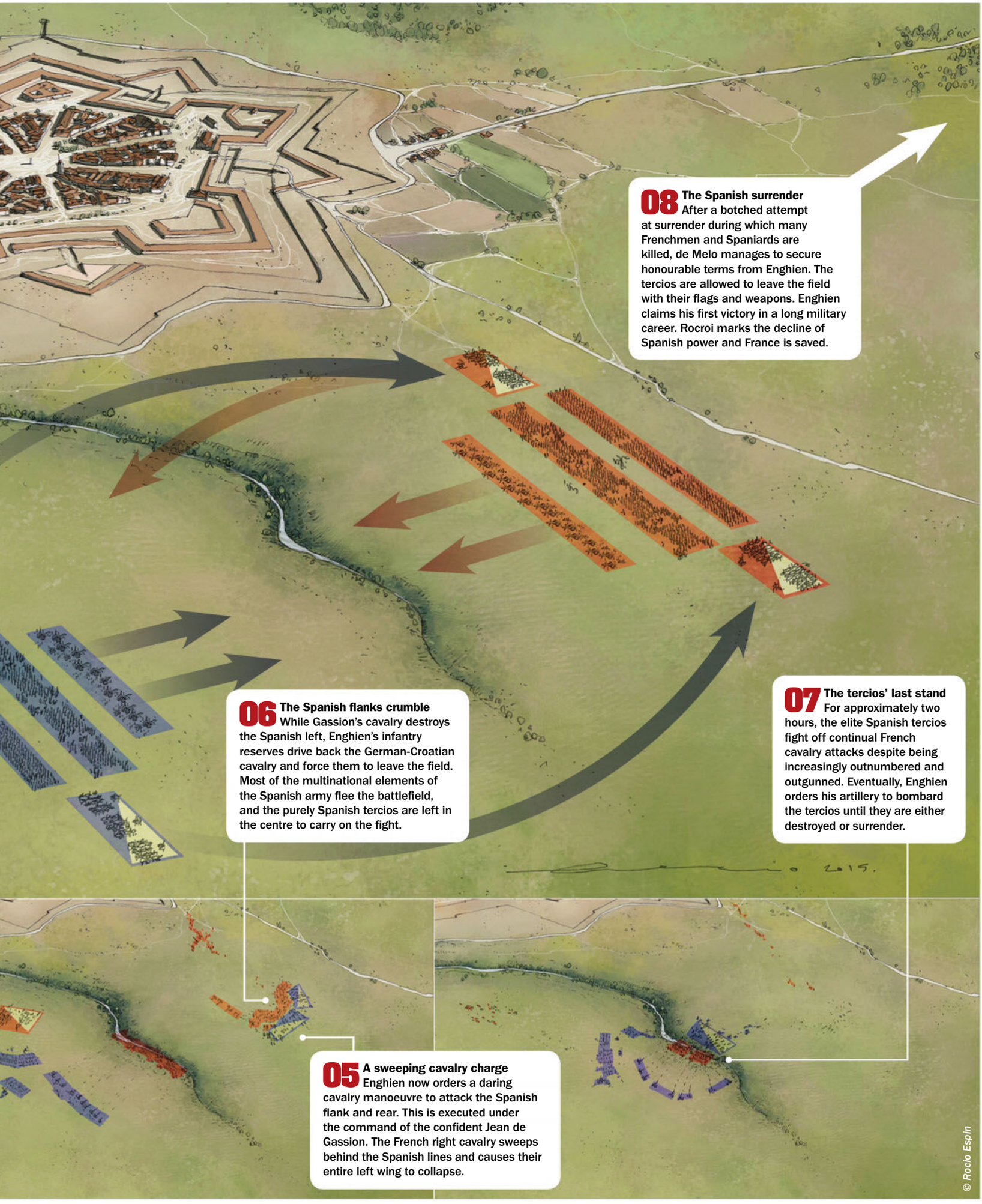
In this sense, the two armies appeared almost identical, both in the deployment of their positions and the numbers of frontline soldiers and reserves involved. Enghien and de Melo were even stationed in their respective right cavalry wings, creating a strange sense of military symmetry. However, one of the unlikely differences between the two armies was loyalty.

The French army, with the exception of some Swiss, Scottish and Hungarian troops, was almost entirely French in its composition. On the other hand, the 'Spanish' army was a melting pot of different nationalities drawn from many different parts of Europe. It would perhaps be more accurate to call de Melo's force an 'Imperialist-Habsburg' army, as the troops all came from lands controlled by Habsburgs, but swore different allegiances, either to Philip IV or the Holy Roman Emperor.

For example, the front line of infantry consisted of five purely Spanish tercios, but five more came from Italy and Franché-Comte. The second line of infantry comprised nine battalions of German, Italian and Walloon troops. The cavalry was equally diverse, as the left wing numbered 15 squadrons of Flemish cavalry while the right had 14 squadrons of German and Croatian horsemen. This diversity of allegiances, under the umbrella of Habsburg authority, would have a decisive effect on the

Below: Along with Pikemen, halberdiers were a small but essential part of the Spanish tercio





08 The Spanish surrender
After a botched attempt at surrender during which many Frenchmen and Spaniards are killed, de Melo manages to secure honourable terms from Enghien. The tercios are allowed to leave the field with their flags and weapons. Enghien claims his first victory in a long military career. Rocroi marks the decline of Spanish power and France is saved.

07 The tercios' last stand
For approximately two hours, the elite Spanish tercios fight off continual French cavalry attacks despite being increasingly outnumbered and outgunned. Eventually, Enghien orders his artillery to bombard the tercios until they are either destroyed or surrender.

06 The Spanish flanks crumble
While Gassion's cavalry destroys the Spanish left, Enghien's infantry reserves drive back the German-Croatian cavalry and force them to leave the field. Most of the multinational elements of the Spanish army flee the battlefield, and the purely Spanish tercios are left in the centre to carry on the fight.

05 A sweeping cavalry charge
Enghien now orders a daring cavalry manoeuvre to attack the Spanish flank and rear. This is executed under the command of the confident Jean de Gassion. The French right cavalry sweeps behind the Spanish lines and causes their entire left wing to collapse.

Louis, duc d'Enghien was 21 years old at Rocroi and had never commanded an army before

***Above:** This matchlock musket was a typical weapon used by arquebusiers in the 1640s*

"THE FRENCH CAVALRY SWEPT AROUND THE REAR OF THE SPANISH IN A GREAT THUNDER OF HORSESHOES AND HUMAN CRIES. ENGHIEN'S PLAN WORKED BRILLIANTLY"

course of the battle. The Spanish may have been exceptionally well trained, but their lack of national cohesiveness meant that units were not fully inclined to support one another in a common cause. To assert Spanish authority, de Melo ensured that Spaniards commanded the majority of his wings and brigades and the core of the infantry centre was filled with the veteran Spanish tercios. The French, on the other hand, were fighting on home territory and were filled with a proud sense of national defiance against a belligerent invader.

At dawn, Enghien opened the battle with an infantry assault on the Spanish centre while the right cavalry wing attacked the opposing Spanish cavalry. The infantry attack failed but the French cavalry managed to rout its Flemish opponent, exposing the Spanish centre to the French. Despite this initial setback, the Spanish centre held its position. Buoyed by the success of its right wing, the French left cavalry disobeyed Enghien's orders and attacked the Spanish right wing in true cavalier style. However, the ground in front of the cavalry was marshy and the horses became bogged down in the muddy ground. The German and Croatian cavalry observed this foolhardy bravado and immediately counter-attacked, driving the stricken French left cavalry from the field. The cavalier attitude of the French horse nearly cost Enghien the battle after only an hour of fighting. The German-Croats attempted to follow up their success by moving to attack the left infantry flank of the French centre – if this succeeded, de Melo's army could have secured a quick victory. However, Enghien moved his reserves up from the rear and blocked the charge of the German-Croats.

Having saved his infantry, Enghien decided to seize the initiative by launching his entire right wing in a great cavalry charge to strike the flank and rear of the Spanish infantry. It was a daring manoeuvre that required great skill in order to execute, as there was a high chance that the French infantry could be exposed. However, Enghien was lucky in that he had a great cavalry captain commanding the right wing: Jean, comte de Gassion. He had extensive experience fighting for King Gustavus Adolphus of Sweden and such was his reputation that Cardinal Richelieu had nicknamed him 'La Guerre' (War). Gassion was a safe pair of hands with which to trust this dangerous gamble.

It would have been a magnificent and frightening sight. The French cavalry swept around the rear of the Spanish in a great thunder of horseshoes and human cries. Enghien's plan worked brilliantly. Faced with this surprise cavalry onslaught, the German, Italian and Walloon infantry completely collapsed and were routed from the field. At the same time, the French infantry reserves broke the German-Croats assaulting the French left and chased them down.

It was now just 8am, and the French cavalry charge, along with the renewed spirit of the infantry, repulsed and routed many of the enemy units. However, this was where the polyglot nature of Spain's army caused problems not just for the Spanish themselves but for the French

The French and Spanish arranged their armies in almost identical formations on marshy ground near Rocroi

too. The units that fled and retreated in the wake of the French onslaught had been the Germans, Italians, Walloons and Croats. None of them had felt a genuine concern to stand by their Spanish comrades and had chosen flight over military cohesion. De Melo's army was now reduced to the purely Spanish tercios, who stood firm as a rock in the centre of the line. They would be very difficult for the French to break, as Enghien was about to discover.

The French general reformed his cavalry and ordered them to directly attack the tercios, despite the fact that both men and horses were tired from charging already. The fatigued French twice attacked the squares but both assaults achieved nothing but bloodshed. The tercios, true to their reputation, remained immovable. Enghien did not want to waste attacks and potentially lose the battle to the stubbornness of the tercios, and he became determined to break them. In a rather un-chivalrous move, he ordered his artillery, along with some captured Spanish cannons, to come up and directly open fire on the obstinate squares. At the same time, he ordered more cavalry charges.

The tercios held firm despite the continual bombardment and cavalry charges. Eventually, though, the superiority in numbers and onslaughts began to tell on the Spaniards, and they became surrounded and outnumbered with increasing casualties. For the tercios, the Battle of Rocroi was turning into a desperate last stand with smoke, fire, noise and death all around them.

"THE FATIGUED FRENCH TWICE ATTACKED THE SQUARES, BUT BOTH ASSAULTS ACHIEVED NOTHING BUT BLOODSHED"

As the battle was drawing to a close, some surviving Spanish officers tried to surrender. According to some sources, when the French came forward to accept their surrender, a group of Spanish soldiers opened fire at the approaching soldiers. The reasons for this are uncertain – either the soldiers did not hear the word to surrender or refused to do so. In any case, this action infuriated the French and they resumed their assault, inflicting many more casualties. Finally, the remnants of the Spanish artillery and arquebuses fell silent, having run out of ammunition. It would have been a dire atmosphere of blood and sweat with the cries of the wounded, desperate and dying to be heard all around.

De Melo, whose exact whereabouts at this stage are disputed, decided to surrender so that his remaining troops would not be destroyed. Although it was obvious that he was defeated, de Melo requested that the French offer the same terms of surrender that were generally made to the defenders of a fortress. This request would mean that the Spanish could leave the field with their colours and retain their weapons. This was a rather presumptuous and tenuous demand for de Melo to make for two reasons: first, as the commander of the defeated army he was in no position to bargain with Enghien. Second, the Spanish had not fought inside the walls of Rocroi but just outside, and so had been fighting in open battle and were technically not eligible for these terms. However, Enghien granted this request in a spirit of generosity and perhaps in a respectful gesture to the bravery of the tercios. The exhausted Spanish left the field defeated, but with their honour intact.

When the fighting stopped, the time was about 10am. Although the substantial Spanish reinforcement of 6,000 men had appeared near to the battlefield, they wisely stayed away as they could see that the battle was lost.

Rocroi had been a bloody encounter with significant casualties. The Spanish lost 7-8,000 men dead or wounded with another 7,000 taken prisoner, while the French lost about 4,000 troops or more. Though the clash did not end the Thirty Years' War, in the short term France was saved from invasion. For the French, it was a highly symbolic victory as it was one of the few major battlefield defeats of a Spanish army in more than a century. The defeat of the tercios in particular was regarded as a great triumph – the Spanish could never replace their elite infantry, and after Rocroi, Spain became a declining power for the rest of the war. It was now the French who would dominate European affairs.

Images: Alamy, Jose Cabrera, Corbis, Mary Evans

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FORGING THE ULTIMATE BLADE

WORDS **PAUL GETHING AND EDOARDO ALBERT**

While axes and bows were among the first instruments of death, the sword is unique as the first weapon created solely to kill; perfecting the deadliest sword soon became a matter of life and death

The first swords ever created are somewhat shrouded in antiquity. From these first bronze blades, swords evolved in a complicated fashion to become the weapons we are familiar with. One of the best examples of these original weapons is the sickle-shaped khopesh buried with the pharaoh Tutankhamun. However, despite being buried circa 1327 BCE, by then, swords were already old.

These weapons were first produced as status items in and around the Mediterranean basin, from roughly 3000 BCE onwards, once the alloying of bronze allowed for the creation of blades. To start with, they were extraordinarily rare, highly prized and a sign of immense wealth. As bronze technology spread, blades became more common, and armies, such as that of the Minoans, were soon well enough armed to carve out their own empire at sword-point.

But the arrival of iron and steel brought another significant advance in the ancient arms race. Iron is strong, durable and readily available, unlike bronze (which required tin – a relatively rare metal). Once the Hittites had demonstrated iron's utility, when carving out their own empire from 1600 BCE, the general adoption of iron weapons became inevitable.

In the first millennium BCE, the Etruscans began to alloy iron and steel to gain better tensile strength. They made blades that had good edge strength while being flexible enough to absorb shock during combat.

The Romans used and developed Etruscan technology, combining it with carburisation (combining iron or steel with carbon to make it harder), case hardening (hard on the outside, soft within) and plain steel blades. Armed with the gladius, the short, stabbing weapon of the legionary, the Roman war machine carved out yet another empire. However, it was the spatha, the longer sword of the Roman cavalry, that outlived the empire. The spatha was often employed by the barbarians serving as Roman auxiliaries and, after the Western Empire fell, it gave rise to the Anglo-Saxon and Viking blades that are the pinnacle of western sword making.

The massed Viking armies of the 10th and 11th centuries inevitably led to homogenised weapons and quality gave way to quantity. In the following centuries, the sword evolved to fit the particular fighting styles of each era that came to pass.

"THE ARRIVAL OF IRON AND STEEL BROUGHT ANOTHER SIGNIFICANT ADVANCE IN THE ANCIENT ARMS RACE"

A SWORD FOR EVERY OCCASION

BLADE DESIGNS HAVE ALTERED THROUGHOUT THE AGES TO REFLECT THE ADVANCE OF BATTLEFIELD TECHNOLOGY

GLADIUS

A short Roman sword used for thrusting, the gladius was used in conjunction with a large shield in phalanx formation with other soldiers. The blades were steel or case-hardened iron, but very rarely made of composites of iron and steel. The Roman army made these swords in vast numbers, with the work probably being commissioned to sword makers (gladiarii).

***Right:** A gladius typically weighed between 0.7-1kg*

CLAYMORE

Not to be confused with the smaller basket-hilted sword of the same name, the claymore was a two-handed broadsword found mostly in Scotland between 1400 and 1700. The design was a constant in the Medieval wars between England and Scotland and it had a unique style of fighting – utilising the long, heavy blade and cross guards to trap and break enemies' blades, and the heavy pommel to strike. The sword could also be easily reversed to make a very effective hooking weapon.

***Right:** Claymores could be up to 1.4 metres long and weigh 2.5kg*

"THE DESIGN WAS A CONSTANT IN THE MEDIEVAL WARS BETWEEN ENGLAND AND SCOTLAND AND IT HAD A UNIQUE STYLE OF FIGHTING"

ANGLO-SAXON/ VIKING SWORD

These swords were derived from the spatha, the long cavalry sword of the Roman auxiliary, and were used for hand-to-hand fighting after the shieldwall broke down. The early Saxon and Viking smiths took pattern welding to dizzying new heights, making some of the finest blades ever forged.

However, with the arrival of massed Viking armies, sword quality declined hugely, although Ulfberht swords, made and signed by a family of smiths in the 9th and 10th centuries, were an exception – they remain unparalleled.

***Left:** Viking-age swords typically had a rounded rather than acute point*

Left: Sabre owners in the Napoleonic era often customised their blades with engravings

THE LOST BAMBURGH BLADE

WAS THIS WEAPON THE PINNACLE OF SWORD DESIGN?

The Bamburgh Sword, forged in the 7th century, excavated in 1960 and rediscovered in 2001, is possibly the finest blade ever made, being created using six strands of pattern-welded iron. An extraordinary weapon like this was the work of more than one man and was likely forged for a royal owner.

The blade, the hilt and the scabbard were made by different people, each a master of his craft. The technology that went into creating a pattern-welded sword is extremely complicated and takes a lifetime to perfect. The men who had this skill were venerated and rewarded richly. However, the technology was jealously guarded, so bladesmiths were not free to leave the king who employed them.

In a time when modern science was hundreds of years in the future, the creation of a perfect blade was a process of magic and ritual.

The very best Early Medieval blades had wootz steel (crucible steel imported from India) alloyed into the pattern welding. This raised the quality of the blades hugely.

The Bamburgh hilt was made of precious metal and stones. Garnets were a favourite; each one was hand shaped by cutting and laboriously polished with a mix of fat and crushed stone loaded onto a leather pad. The gold work would have been extraordinary and the level of minute detail must have required an immense amount of time and patience. How this was done without magnification is a mystery still.

Below: This close-up of pattern-welded steel (also known as Damascus steel) reveals the pattern created on the blade during the forging process

SABRE

The sabre – as most often thought – was a curved, single-edged blade used by cavalrymen, in particular during the Napoleonic Wars, when it was wielded to sometimes devastating effect on routing infantry formations. But in fact, Napoleonic-era sabres were just as often straight blades, used for thrusting attacks by charging cavalry. The sabre remains part of the dress uniform of many military units, while modern sport sabre fencing is alone in counting slashing strokes as hits, although the sword itself is straight, not curved.

"THE SABRE REMAINS PART OF THE DRESS UNIFORM OF MANY MILITARY UNITS"

RAPIER

In contrast to the previous weapons, the rapier was not a soldier's sword. This one-handed, long, thrusting blade was developed in the 16th and 17th centuries as a civilian self-defence weapon. It was a personal sword, carried every day, and one meant to be used in the brawls, fights and duels that plagued Renaissance Europe's cities. The rapier required a fighting style based on thrusting the sword rather than slashing with it – modern sport fencing styles have developed from rapier duelling.

"MODERN SPORT FENCING STYLES HAVE DEVELOPED FROM RAPIER DUELLING"

Left: Rapiers usually featured a complex hilt designed to protect the hand wielding it

Bamburgh Castle, where the Bamburgh Sword was discovered in 1960 by archaeologist Brian Hope-Taylor

HOW TO MAKE THE PERFECT SWORD

THE BAMBURGH BLADE WAS FAR MORE THAN A WEAPON – IT WAS A 7TH-CENTURY WORK OF ART

The technology required to make the Bamburgh Sword, and similar pattern-welded weapons, was staggering. First the finest bog ore was smelted to make iron and steel, then the iron was forged into regularly twisted bars. These were then welded together to form a perfect chevron pattern, and the basic sword shape was formed. The very finest blades had wootz (crucible steel) added to reduce imperfections. The steel edge was then welded to the core, which made the sword flexible and fluid in the hand. The steel edge made the blade wickedly sharp, but it was the interplay between iron and steel that was key to the success of these magical blades.

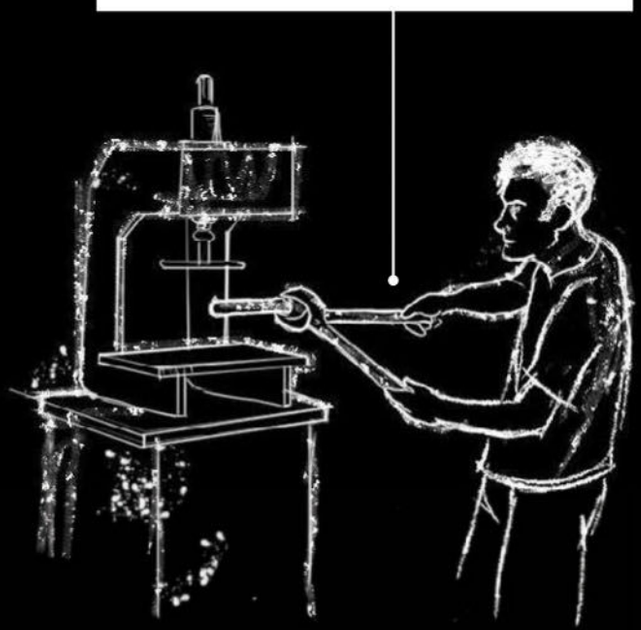
The blade was fullered and ground to shape, then heated and quenched several times to normalise. Next it was heated and quenched in water or brine – at this point the metal was brittle, so it would be reheated to a lower temperature and allowed to cool slowly. Once sharpened and affixed to a fine hilt, the result was a statement of intent and an announcement of its owner as a superior warrior – one likely to kill you.

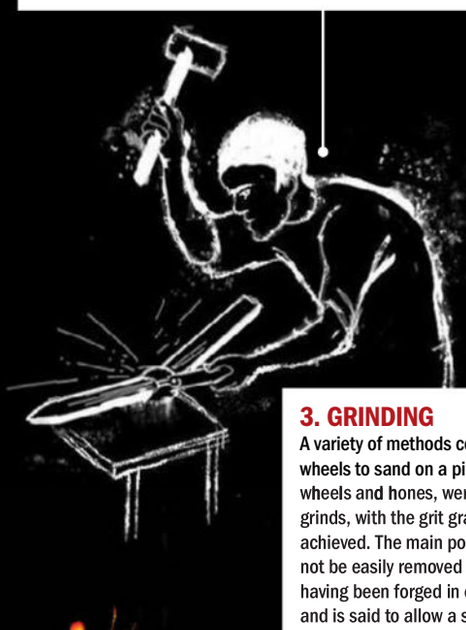
1. CHOOSE YOUR METAL

The single most important aspect of a good sword was the material it was made from. It needed to be light and strong, flexible but not brittle, and capable of achieving a sharp edge and point. Iron is soft and will not hold an edge well. Steel can be sharpened and will hold an edge, but the increase in hardness makes it much more brittle. The ideal trade off was a weapon that had a flexible iron core and a sharp steel edge welded on.

2. FORGING

The only way to successfully fuse iron and steel was to forge them. The superheating of the metals created thousands of tiny welds that united them. An added bonus of forging was that any impurities in the metal would be spread evenly around the blade, reducing the chances of failure through stress. This can cause the blade to bend or even snap – not good in the midst of battle. Bars of good grade iron were twisted in a regular pattern. This working further dispersed any impurities. The bars were welded together to make a solid core and the steel edge was then welded on. A channel was opened around the edge of the core and the steel was welded into this. Closing the channel locked the steel into place, making a strong bond.





3. GRINDING

A variety of methods could be used to grind a blade, from water-powered wheels to sand on a piece of leather, although hand files, as well as stone wheels and hones, were used. The blade was moved through a variety of grinds, with the grit gradually getting finer until the desired shape was achieved. The main point of grinding was to remove the material that could not be easily removed by forging. The fuller was also finished at this stage, having been forged in earlier. A fuller is often described as a blood groove and is said to allow a sword to be pulled out easily, but this is not true. The fuller lightened the blade and increased its strength.

"THE TECHNOLOGY REQUIRED TO MAKE THE BAMBURGH SWORD, AND SIMILAR PATTERN-WELDED WEAPONS, WAS STAGGERING"

"ONCE SHARPENED, THE RESULT WAS A STATEMENT OF INTENT AND AN ANNOUNCEMENT OF ITS OWNER AS A SUPERIOR WARRIOR – ONE LIKELY TO KILL YOU"

4. ANNEALING

Iron and steel were hammered into a blade shape and then heated until the metal ceased to be magnetic. This made the metal soft enough to work easily for shaping. It was essential to heat the blade along its entire length to get a uniform finish. The charcoal in the forge needed to be arranged so that the length of the blade was in maximum contact with the flames, to keep all of the blade at the same temperature. The sword had to be cooled very slowly: either the fire was allowed to cool, or the sword could be buried in hot sand that retained heat.

5. HARDENING

The sword was reheated to a dull orange until non-magnetic. It was essential not to overheat the point and edge, as carbon could easily burn out of the steel. Knowing his forge was essential for the sword smith. The sword was then quenched in water. A thermal jacket formed around the blade from the steam, so movement was essential to allow for a better quench. This process aligned the crystalline structure in the iron and steel and promoted grain growth.

6. TEMPERING

The blade was brittle after hardening, so it had to be reheated precisely. This was done using colour – heated metal glows different colours depending on its temperature. For tempering, the sword smith heated the blade until the edge was a straw colour and the centre, where more metal was, a deep purple. The blade was then allowed to cool slowly, thus allowing some flex back into the blade to ensure it did not snap in use.

7. COMPLETION

The blade was now forged, but it looked a sorry state. Dirty and blackened, it had to be cleaned thoroughly. Abrasives were used to scour away the forge detritus. The blade was polished slowly, using gradually less coarse media and after a final sharpen, it was etched in a caustic medium to highlight the contrast between iron bands and steel. This created the result that pattern-welded swords are famous for. The hilt of a fine sword was always on display, so jewelled, precious metal hilts with prestigious materials such as exotic wood or ivory were used. The hilt was composite and the pommel and guards were adjusted to balance the blade for its owner. The scabbard was similarly made of fine wood, bound in leather and lined with sheepskin. The lanolin in the scabbard's lining helped maintain the blade.

Illustration: Ligia Duque

THE KATANA

HOW THE LEGENDARY SAMURAI SWORD GAINED ITS EDGE

Extraordinary stories have been attached to these single-edged, curved blades, from the blood thirst of Muramasa's swords to the holy swords of master bladesmith Masamune, which would only harm that which was evil.

As the pattern-welded blade was rising to prominence and then being replaced by mass-produced inferior blades in Europe, a similar technique was rising in Japan. The technology was startlingly similar, yet very different. The tatara, a form of industrial smelting, was used to extract tamahagane steel and iron from the iron sands that are the main ore source in Japan.

Tamahagane is high-quality steel, but the carbon content is variable. The bladesmith separated the steel into highest and lower carbon. The low-carbon steel (shingane) was forged into a core and the higher-carbon steel was forged into layers that were then sandwiched together around this forged core into a blade shape. The outer blade could be folded many times to form a laminated sword in which the impurities were spread evenly throughout the blade, much like they are in pattern-welded swords.

Between each forging, the blade was coated in clay mixed with ash. This helped to draw out impurities from the steel as it was heated and burned off in the intense temperature of the forge.

The skill in forging a katana lay in making certain that the soft core and laminated outer skin were correctly aligned and positioned in the finished blade. Like a pattern-welded blade, this skill took a lifetime to master.

The katana was not heat-treated in the same way as a European sword. The softness of the back of the blade was maintained by coating it in a thick layer of clay, which was thinned towards the blade edge. This kept the high heat that hardened the blade confined to the cutting edge, thus allowing the other parts of the blade to remain soft and springy.

Using clay could produce a blade without tempering, but usually a light temper was needed to reduce brittleness. The clay also created a beautiful wavy line down the blade (hamon). A perfect hamon was – and is – a sign of an excellent blade, acting as a mark of quality.

The forged sword was then passed to the polisher who cleaned and polished the blades using decreasingly abrasive water stones. This polishing could take weeks and is itself still a fine art to master.

The finished blade was then sent for a finely decorated handle and scabbard. The finest Japanese swords were made by a group of skilled craftsmen – the bladesmith was a master and directed a group of apprentices. The master did little of the heavy work, but directed exactly. Often, he would tap the metal with a light hammer and the weight and location of the strike was duplicated by an apprentice with a larger hammer.

The master was there for his skill, not his strength. Japanese master bladesmiths achieved mythological status and there are many folk tales that describe smiths meeting each other and holding forging competitions.

For instance, Muramasa was supposed to have challenged Masamune to see who could make the better sword. Blades made, the two masters hung their swords in a stream. Muramasa's sword sliced everything: fish, leaves, the air itself. But Masamune's blade touched nothing. Thinking he had won, Muramasa jibed his master, until a watching monk explained that, while the first sword cut everything, the second, Masamune's blade, was superior, since it discriminated, leaving untouched that which did not deserve to be harmed. Sadly, this wonderful tale is apocryphal – Muramasa and Masamune were separated by generations and never met.

"A PERFECT HAMON WAS – AND IS – A SIGN OF AN EXCELLENT BLADE, ACTING AS A MARK OF QUALITY"

Katanas were traditionally worn with the sharpened edge facing up, making it possible to draw the sword and strike the enemy in a single motion

***Left:** The distinct hamon can be seen down the side of the blade*

This engraving shows Japanese Blacksmith Munechika being helped to forge by a fox spirit

***Far left:** Inscriptions on the katana's tang can help identify it*

Images: Getty Images; Thinkstock

Heroes of the Medal of Honor

LESLIE SABO JR

Barely a year into his military career, Sergeant Sabo would become legend in one of the most awe-inspiring acts of courage and valour of the Vietnam War

WORDS **DOM RESEIGH-LINCOLN**

Born on 22 February 1948 in the Austrian town of Kufstein, Leslie Halasz Sabo Jr was the third son of two upper-class members of a once-powerful Hungarian family. The Sabos had lost their fortune in the aftermath of World War II, but they had also lost something far more precious – one of their sons, who died during the bombing raids of the war at the age of one. The end of the war also saw the arrival of the Red Army. Fearing the installation of a totalitarian infrastructure, his mother and father decided to pull up their roots and flee the country with Leslie and his older brother George, to seek a new life elsewhere.

The Sabos arrived in the United States in 1950 when Leslie was just two years old. The family initially moved to the centre of the US steel industry, Youngstown Ohio, but soon relocated to Ellwood City, Pennsylvania. Despite hailing from war-torn Europe, Sabo Sr expected nothing more than strict discipline and patriotism from his family for their new adopted home. The USA had welcomed them in the aftermath of the war and enabled them to start afresh – it was the least they could do to pay back such a gesture.

His sons took their father's sentiment to heart, but these were two young boys growing into men in late 1950s and early 1960s USA, so Sabo and his brother were just as excitable and carefree as any other youth of their time. Sabo often enjoyed bowling or shooting pool and his brother recalled him being a decent kid all round.

That clean-cut image saw Sabo through his early education and he soon graduated from Lincoln High School in 1966. He then went on to study at Youngstown University, but after a year of college, he realised it wasn't for him. Following his premature departure from education, Sabo took a job in the industry of his hometown – steel. He would continue working at a local steel mill until he was drafted in to the army two years later.

Sabo joined the United States Army in April 1969 and attended Basic Combat Training at Fort Benning, Georgia, before moving onto Advanced Individual Training (AIT) in September. A soldier in training he may have been, but that didn't stop his life from moving forward in other ways. Before joining the forces, Sabo had proposed to the love of his life, Rose Buccelli, but the two had planned their wedding for the same month as his new phase of training. Thankfully,

***Below:** Due to administrative errors, the petition to reward Sabo's efforts with the Medal of Honor was lost in the 1970s. More than 42 years later, his widow Rose was finally presented with his posthumous award*

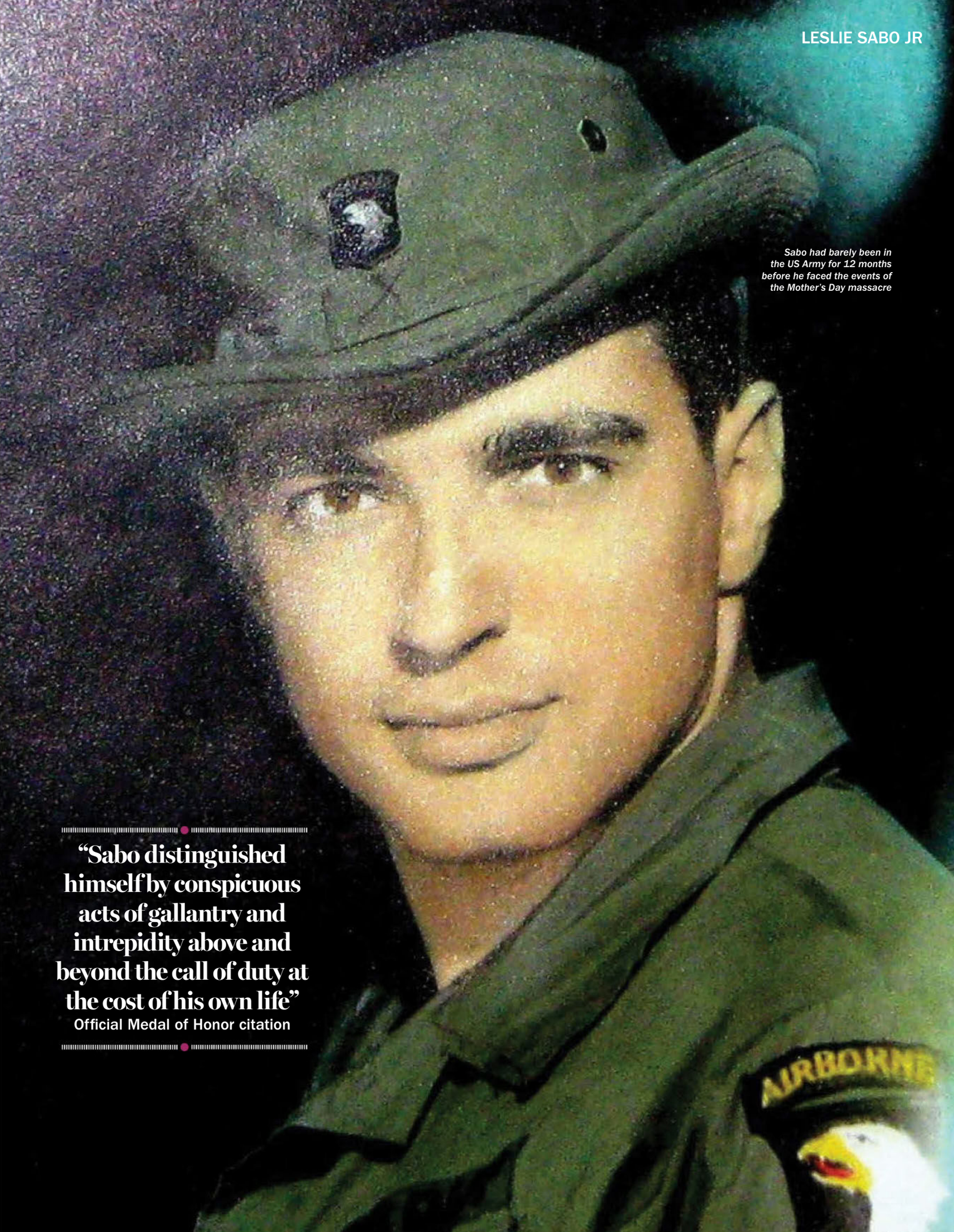
the army granted him a brief window of leave and the two were joined in matrimony.

With AIT now wrapped up, he was assigned to Bravo Company, Third Battalion, 506th Infantry Regiment, 101st Division. Trained as a rifleman, Sabo was deployed to Vietnam in January 1970 and thrust into the heart of conflict that had been raging since 1955. But Sabo wasn't afraid – he wrote to his wife regularly, describing how much he enjoyed the discipline of the army and how his platoon had often come into contact with troops from the main force the US was fighting against, the North Vietnamese Army (NVA).

On 10 May 1970, Sabo's platoon had been temporarily attached to the Fourth Infantry Division and tasked with performing interdiction tactics (the act of disrupting an enemy's normal activities) in Cambodia along the Ho Chi Minh Trail (the main logistical route used by the NVA during the war). The plan was to use ground troops such as the Fourth that could be supported with heavy air support when contact with the enemy was made. Things, however, did not go as expected.

While two platoons' worth of American GIs made their way along the trail, an ambush was sprung. 150 NVA soldiers had been tracking the movement of the troops and begun to gather surreptitiously in the cover of the surrounding jungle. Then, the NVA attacked. Soldiers fell straight away and the American troops were in disarray. As the reality of the ambush dawned on Sabo, he charged the enemy. Shouting at his men to do the same, he headed down the line and brought an offensive against the NVA attackers at the other end of the column of troops. Some of the NVA soldiers retreated, giving the Americans a brief moment of respite.

Now out of ammunition, Sabo sprinted across the open field and began reloading his rifle next to an injured American soldier. Suddenly a



LESLIE SABO JR

Sabo had barely been in the US Army for 12 months before he faced the events of the Mother's Day massacre

"Sabo distinguished himself by conspicuous acts of gallantry and intrepidity above and beyond the call of duty at the cost of his own life"

Official Medal of Honor citation

"Without hesitation, Specialist Four Sabo charged an enemy position, killing several enemy soldiers"

Official Medal of Honor citation

grenade bounced into view, thrown by an NVA soldier. Without even thinking, Sabo threw the grenade away and dove on his incapacitated fellow trooper. His selfless act kept the soldier safe, but Sabo took the worst of the blast.

However, this was no time to stop and count wounds, the Mother's Day Ambush (as it would come to be known) was still unfolding and his men were dying. A nearby enemy trench was laying waste to his men, the NVA soldiers' dug-down position providing them enough protection from any returning fire. Sabo threw a grenade of his own into the trench, killing two of the attackers inside.

With his fellow soldiers running low on ammunition, Sabo continued to put his own life on the line – running across the chaos of the ambush, collecting ammunition from fallen GIs and redistributing it back to his brothers in arms. He would even pop himself out of cover and draw enemy fire so his fellow soldiers could retreat or find better cover. In many of those instances he was hit, but the young man still fought on.

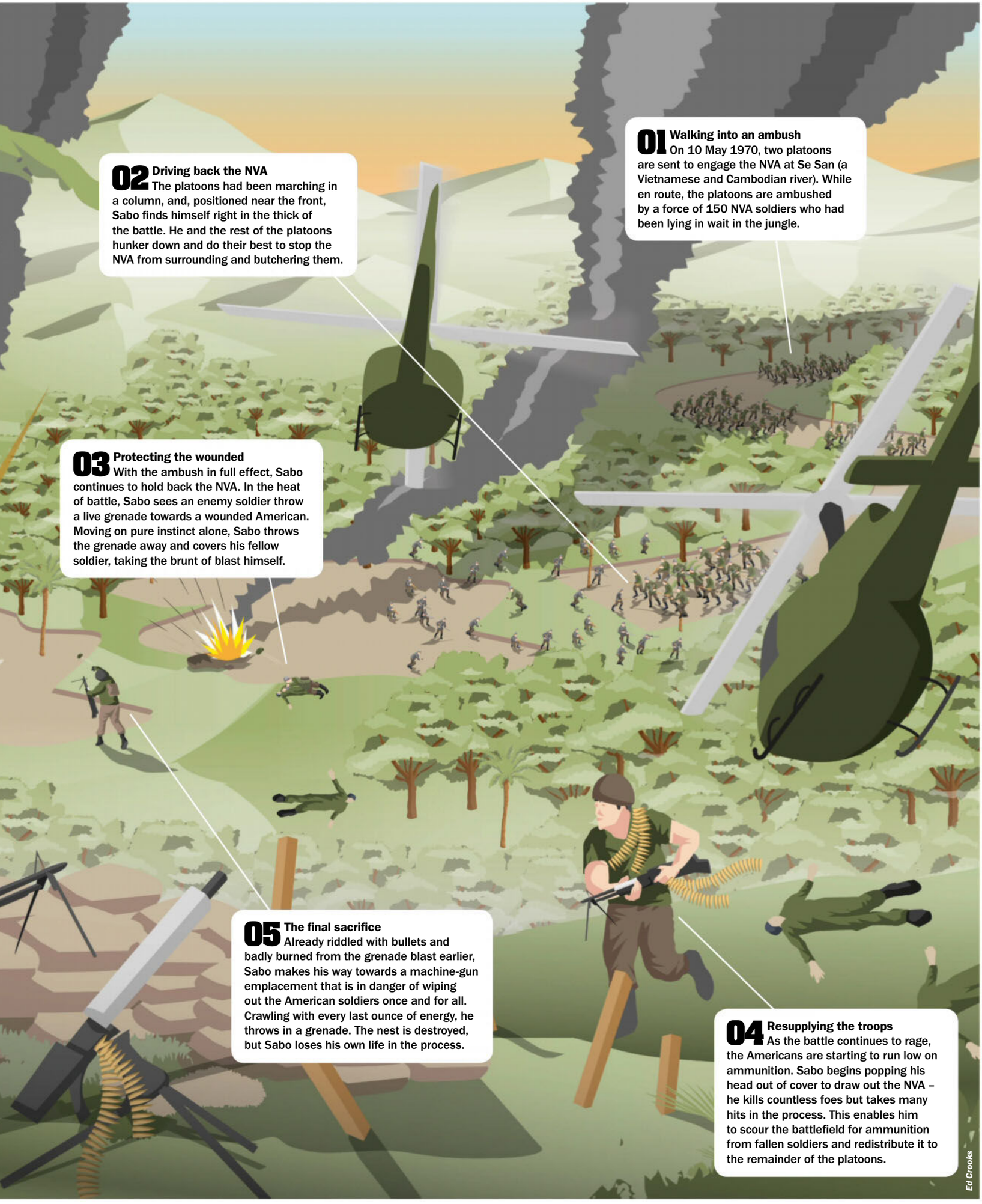
As night began to fall, American helicopters, being fired at by NVA soldiers, were unable to ferry the two dozen wounded left on the battlefield away. Sabo once again put himself in harm's way, providing covering fire and killing NVA soldiers in the process. What was left of Bravo Company broke through the Vietnamese lines and relieved the remaining troops, but the helicopters then came under pressure from a bunker close by. Realising that the rest of his platoon wouldn't survive with the NVA troopers keeping the choppers at bay, he advanced on the bunker, firing shot after shot until his ammunition was exhausted.

Taking even more fire, Sabo dropped to his knees. But he refused to give in and dragged himself on until he was close enough to make one last gesture of defiance. He drew out a grenade, pulled the pin and threw it with every last drop of energy inside him. The grenade landed true and destroyed the bunker, silencing it for good. But Sabo was too close when it exploded, and the blast took his life as well. His sacrifice gave the remainder of his platoon the time it needed to evacuate, saving countless lives. Sabo was aged just 22.

Yet, as grand and selfless as his acts were, Sabo's efforts on that dank Cambodian field were lost to the chaos of the Vietnam War. He was posthumously promoted to the rank of sergeant, but the nature of his death remained a mystery to his family (the US Army officially stated he had been killed by a sniper while guarding an ammunition cache). Although his company commander requested he be awarded the Medal of Honor, the documents were lost and Sabo's sacrifice forgotten.

That was until 1999 when another Vietnam War veteran and columnist discovered the official report from the Mother's Day ambush. He published his discovery in a divisional newspaper and wrote to his local congresswoman imploring her to help Sabo's story be told and properly recognised. It took another seven years before the Department of Defense agreed to grant him the highly deserved Medal of Honor, and another six for it to be finally awarded and presented by Barack Obama to his widow Rose. Despite more than four decades of obscurity, Leslie Sabo's awe-inspiring sacrifice could finally be recognised in the manner it deserved.

Despite the losses Sabo and his men endured, the two platoons managed to inflict more casualties on the NVA by the end of the battle



01 Walking into an ambush
On 10 May 1970, two platoons are sent to engage the NVA at Se San (a Vietnamese and Cambodian river). While en route, the platoons are ambushed by a force of 150 NVA soldiers who had been lying in wait in the jungle.

02 Driving back the NVA
The platoons had been marching in a column, and, positioned near the front, Sabo finds himself right in the thick of the battle. He and the rest of the platoons hunker down and do their best to stop the NVA from surrounding and butchering them.

03 Protecting the wounded
With the ambush in full effect, Sabo continues to hold back the NVA. In the heat of battle, Sabo sees an enemy soldier throw a live grenade towards a wounded American. Moving on pure instinct alone, Sabo throws the grenade away and covers his fellow soldier, taking the brunt of blast himself.

04 Resupplying the troops
As the battle continues to rage, the Americans are starting to run low on ammunition. Sabo begins popping his head out of cover to draw out the NVA – he kills countless foes but takes many hits in the process. This enables him to scour the battlefield for ammunition from fallen soldiers and redistribute it to the remainder of the platoons.

05 The final sacrifice
Already riddled with bullets and badly burned from the grenade blast earlier, Sabo makes his way towards a machine-gun emplacement that is in danger of wiping out the American soldiers once and for all. Crawling with every last ounce of energy, he throws in a grenade. The nest is destroyed, but Sabo loses his own life in the process.

Ed Crooks

Yom Kippur War

The 1973 Arab-Israeli war may have lasted only 20 days, but it violently shifted the balance of power in the Middle East region forever

WORDS **MARWAN KAMEL**

When Israel launched a surprise attack in 1967 that destroyed Syria and Egypt's military capacity and effectively tripled the country in size, it was sure that it had clearly demonstrated its overwhelming, pre-emptive military capability to shift power. While Syria lost two-thirds of its fighting capacity in material and Egypt most of its air force and a significant number of tanks, the Six-Day War earned Israel huge territorial gains. Jordan was ejected from Jerusalem and the West Bank, and Sinai was taken from Egypt and the Golan Heights from Syria. Crucially, Egypt also lost control of the Suez Canal to Israel, which erected a line of fortifications along the east coast (the Bar Lev line) to secure and restart the flow of Israeli shipping through the Red Sea to the Mediterranean. In short, the defeat was a triumph for Israel, and equally as humiliating for the Arab nations, who signed the ceasefire begrudgingly.

So began the War of Attrition. Former journalist Mohamed Hassanein Heikal, who would be appointed Egyptian minister of information in 1970, stated in 1969: "This course, which meets all the requirements and necessities and is in harmony with logic and nature – this main course to tip the balance in our favour, or merely to adjust it is: to inflict a clear defeat on the Israeli Army in battle, in one battle… I am not speaking of a battle on the scale of that of 5 June 1967 – a 5 June in reverse… Most likely 5 June will not be repeated… In the coming battle, neither we nor the enemy will be taken by surprise."

The rhetoric began to ramp up further in 1971 and 1972, and as tensions mounted, Syria and Egypt planned for an attack. They accrued supplies, which they had implored the Soviet Union to provide in the wake of the devastating 1967 defeat. Both countries started gathering hidden masses of equipment along the official ceasefire line, called the Purple Line, between Syria and Israel. Jordan had lost its appetite for war and feared further territorial losses, so King Hussein opted not to participate. The plan was named Operation Badr, after the battle in which the Prophet Muhammad's army returned to Mecca and seized it from the pagan Quraysh.

Despite this careful planning, Israel became aware of the attack beforehand through its intelligence sources. However, the reports were not taken seriously because a top, and suspect, Mossad agent named Ashraf Marwan – former Egyptian President Gamal Abdel Nasser's son-in-law – had previously given a mistaken date for the attack of May 1973. Meanwhile, US policy sought to avoid conflict altogether and Henry Kissinger convinced the Israelis against using a first-strike policy. He also encouraged the Soviets to do the same with their clients.

Nonetheless, the co-ordinated attack came on 6 October 1973. The Egyptians chose the date according to when the tidal conditions would be most favourable for crossing the canal. It happened to also coincide with both the high Jewish holiday of Yom Kippur and the tenth day of the Muslim holy month of Ramadan.

Initial success for Egypt and Syria

In the first few hours of the war, the Syrian and Egyptian armies achieved unprecedented successes. Ariel Sharon, then an Israeli tank commander, commented: "These were soldiers who had been brought up on victories… It was a generation that had never lost. Now they were in a state of shock.

At approximately 2pm on the first day, Egyptian President Anwar Sadat ordered his troops across the canal. They crossed in rubber dinghies and landed on the opposite side, establishing a bridgehead. Immediately they came up against a massive sand embankment, which slowed their progress and meant they could not advance their tanks deeper against Israeli defences and into Sinai.

Egyptian engineers used ladders to construct bridges in an attempt to allow armour over the Israeli sand wall, while their fellow soldiers started to dig. The attack's commander, Saad el Shazly, found this far too slow, and feared

Israeli soldiers in Golan Heights stand atop their tank

THE BATTLE FOR SINAI AND THE GOLAN

5 October
Ashraf Marwan warns Israeli intelligence chief Zvi Zamir of an imminent attack the following day at 6pm. Unfortunately, after a previous false alarm, they fail to heed his warning.

6 October
Egypt and Syria begin their attack with the intent of liberating the Sinai Peninsula and Golan Heights, which Israel occupied six years earlier during the Six-Day War. Syria crosses the Purple Line. The Egyptian air force jets cross Suez Canal.

6 October
The Israeli cabinet skips morning Yom Kippur prayers for an emergency meeting where they decide to mobilise reservists, who comprise the bulk of the Israeli army.

that this impeded progress would allow the Israelis time to reinforce their lines. Finally, one of his men suggested blasting the walls with high-pressure water from hoses directly from the canal. The idea worked, and the defences started to erode into passages for machinery and infantry to move through. Later that day, the Egyptians broke through.

Meanwhile, huge numbers of Syrian tanks poured across the Purple Line, supported by infantry and preceded by air strikes and artillery barrages. It was far from a blitzkrieg, however. The Israelis were extremely well entrenched, but were overwhelmed by numbers, especially in the southern portion of the Golan, near the village of Rafid. Syrian tanks even caused a traffic jam, as engineers had failed to build bridges or mechanisms for overcoming anti-tank trenches. On the day, persistence and numbers compensated.

At some points, the Syrians didn't even bother attempting to clear out tunnels or trenches, simply choosing to bypass them. They met slowly withering resistance and took heavy casualties, but pressed on to the Israeli command at Nafah and the Sea of Galilee.

Syrian helicopters next dropped commando units to take the Mount Hermon (Jabal al Shaykh) stronghold, which included a listening post with surveillance and intelligence equipment. Once it was clear they had created a gain, however, the Arab armies suddenly stopped and tried to hold the lines, which allowed for the Israeli forces to launch devastating counterattacks.

It was clear to the Israelis that these were not the ragtag armies who had fought them in the past. Nonetheless, the Syrian and Egyptian armies, apart from their initial cohesion at the onset, were still largely unco-ordinated and inefficient. The two allies traded accusations of betrayal for allowing the Israelis to prepare, and not relieving pressure off the other's front.

Technological showdown

Superior military technology was a deciding factor in the initial Arab successes, but also their Achilles' heel, as it drove the US towards more significant rearmament and attempts to shift allegiances following the war. For the superpowers – the US and USSR – it provided an opportunity to have their clients test their latest toys in full combat.

At the outset of the war, Israel never expected an attack from either Syria or Egypt, as it had devastatingly reduced their military capacity in 1967. Unknown to either the CIA or Mossad, by October 1973, the USSR had rearmed both states with the latest technologically advanced weapons systems. These included, among other things, air defence missile systems, infrared technology, guided anti-tank missiles and night-vision.

"It was clear to the Israelis that these were not the ragtag armies who had fought them in the past"

It was clear that Israel had air superiority, but Egypt and Syria attempted to level the playing field through a heavy reliance on their surface-to-air missiles (SAM), which were advanced anti-aircraft rocket systems.

In Sinai, Egypt's reliance on its SAM rocket batteries hindered its troops' forward movement. They hesitated to leave the cover of their air defences and effectively halted just a few kilometres from the east bank of Suez – at the edge of their range. Similarly, they inflicted heavy losses on Israeli tanks with guided Sagger anti-tank missiles.

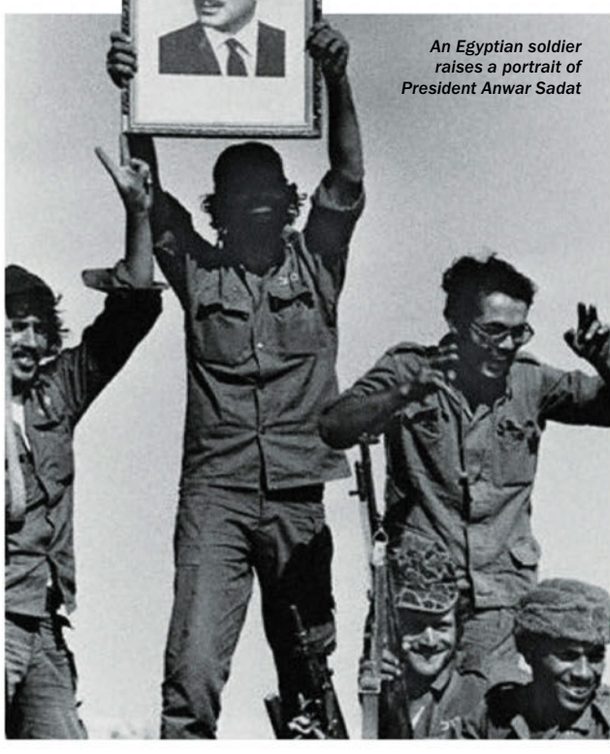
Eventually, when Sadat commanded his troops to advance in a bid to relieve pressure on the Syrian front, his troops left the range of their protective canopy and Israel was able to force them on the defensive, with Ariel Sharon's salient finally destroying some of the batteries on the west bank of Suez at the war's end.

Just like in Sinai, the Syrian positions in Golan were initially difficult for the Israeli Air Force (IAF) to hit. In one exchange, an operation codenamed Doogman 5, six Israeli planes were downed in exchange for taking out one SAM battery. Once Israel had recalibrated and found an alternate route, the air force was able to bypass the defences and even hit the General Command Headquarters of the Syrian Army. This forced the Syrians to withdraw some air defences to the heartland and allowed the IAF greater freedom of movement to destroy positions in Golan.

Israel's counterattacks were not only guaranteed by superior airpower, but the fact that their Centurion tanks were more heavily armoured than either Arab army's largely outdated Soviet armour. Although Syria and Egypt had superiority in numbers, their tank units were largely comprised of T-55s, supplemented by newer units, but also by a number of extremely outdated World War II-vintage self-propelled guns. The Israeli tanks' turrets could also outmanoeuvre, out-aim and out-rotate the Soviet equipment, which proved decisive, especially in the mountainous Golan.

The end result was that Israeli tanks could take more damage, and took out Arab tanks on both fronts in disproportionate numbers. This meant they held strong enough defensive lines

Israeli artillery units fire a field gun among mountains of spent rounds in the Valley of Tears in the Golan. The Syrian Army bore the brunt of the Israeli army's force as Egyptian movements stagnated in Sinai



An Egyptian soldier raises a portrait of President Anwar Sadat

7 October

100,000 Egyptian soldiers, more than 1,000 tanks and 10,000 others cross the Suez Canal with minimal losses. Syrian forces capture most of the southern portion of the Golan Heights with forces of about 1,200 tanks.

8 October

Israel counterattacks Egypt and fails. The Syrian army continues to make gains and re-occupies the regional capital, Quneitra, which had been occupied in the 1967 war. After this, the Israeli cabinet decides to focus its attacks in the Golan.

9 October

Israel destroys hundreds of Syrian tanks in the Valley of Tears in Golan Heights. The First Syrian Armoured Division tries to capture the regional Israeli HQ at Nafah and fails. Israel regains its lost territories, but does so at great cost.

12 October

Israel moves 12 miles past the Purple Line, capturing territories inside Syria, but do not achieve breakthrough on the road to Damascus as entrenched Syrian reserves provide stiff resistance. Later, they are reinforced by modest units from Jordan and Iraq.

13 October

The British ambassador tries to propose a UN ceasefire resolution. Anwar Sadat refuses the offer and claims to only accept a ceasefire if Israel completely withdraws from the entirety of Sinai.

Below: *The Israeli commander of the Port Tawfiq Fortress surrenders to Egyptian forces on the first day of the war, 6 October 1973*

"The world found itself in a Cold War standoff that had the potential to escalate into a thermonuclear conflict"

that gave them time to bring up reinforcements that would turn the tide.

When Israel was at its most desperate, its defence ministry began mulling over the option of using its nuclear arsenal as a last resort, but pressed the US for a resupply. Kissinger realised a defeat at the hands of Soviet-backed Arab states would be a geopolitical nightmare, so the US launched Operation Nickel Grass to airlift weapons to the Israelis. In total the US brought Israel more than $2.2 billion in additional emergency military aid.

In response, and following an Israeli violation of an agreed ceasefire when its forces pressed on in Egypt, Soviet premiere Leonid Brezhnev threatened to put Soviet troops in the region. The Soviets began a resupply of Syria and Egypt, and the world found itself in a Cold War standoff that had the potential to escalate into a thermonuclear conflict. US troops were put on high alert. When the conflict concluded, the US used a complete return of the Sinai peninsula as political leverage to switch Egypt to the USA, rather than Soviet aid.

National attitudes

The Yom Kippur War wasn't to be decided on the merits of technology alone – public attitudes towards the conflict, on all sides of the conflict, heavily influenced how each belligerent fought. This was true previously in the Arab-Israeli conflict, and it proved to be a determining factor in October 1973.

The initial Syrian advances put its troops within striking distance of major Israeli population centres, and the Syrian Army even hit an Israeli air base in Ramat David and numerous other targets with 9K52 Luna-M (Nato name 'FROG-7') rockets. Israel saw itself in a battle for its very survival. The fact that the war had begun on the holiday of Yom Kippur only exacerbated its urgency in the eyes of the ordinary Israeli public.

It is unclear whether the Arab armies really ever intended to wipe Israel out completely – both of them stopped short of penetrating into the heart of Israel itself. Instead, they hesitated to move any further than the pre-1967 borders. In the Golan, Syria reached the edge of the heights and stopped abruptly, with bewildered Israeli troops looking on. It was Israel's counterattack that pushed past the Purple Line into Syria.

Attitudes within the general populations of the countries were polar opposites. When Israel went to war, the entire country was conscious of the effort and shifted into a supporting mode. This esprit de corps allowed reservists, who formed the bulk of the army, to scramble very quickly in the 1973 war. The Syrian army in Golan had expected that Israel would mobilise its reservists within 24 hours, but in fact they scrambled reinforcements within 15.

14 October

According to Israel, more than 200 Egyptian tanks are destroyed and 400 Egyptian troops captured. According to Egypt, 150 Israeli tanks and 24 Israeli aircraft are destroyed.

15 October

Israel crosses the Suez Canal. Sadat makes his first public appearance since the beginning of the war and leads a victory parade in Cairo. The Battle of Chinese Farm begins.

16 October

Arab members of OPEC raise the price of crude oil by 70 per cent and place an embargo on exports to the US and other nations allied with Israel, as a direct response to the war.

18 October

Israel decides to capitalise by increasing its presence on its western bank to three armoured divisions after successfully crossing the Suez Canal.

21 October

Sadat informs the Soviet ambassador to Egypt that he is ready to agree to a ceasefire. This is the first of many negotiations between the two sides. The Israelis have no interest in an agreement.

22 October

Resolution 338 is adopted by the UN Security Council calling for a ceasefire and stipulating that fighting should stop at 6.52pm Middle Eastern Time.

Israel was well aware of its perception in the international community's eye. As the Israeli cabinet discussed the future of its operations in Golan, Israeli prime minister Golda Meir insisted that the army press into Syria's Bashan region. If the war had ended as the Israelis began to shift a division to the Sinai front, which could have taken as long as four days, then Israel would have suffered a territorial loss in the south and no gain in the north, which would have been perceived as a defeat.

At the conclusion of the war, Meir spoke in front of the Israeli Knesset and said: "The war in which we are engaged began with a concerted attack on two fronts. The aggressive initiative afforded our enemies preliminary achievements – but, thanks to the spirit and strength of Israel's Defense Army, which is backed by the entire nation, the attack was broken. The aggressors were thrown back. Considerable portions of their forces were destroyed, and the IDF broke through and crossed the ceasefire lines. From holding battles our forces went on to the offensive and gained brilliant achievements."

The Arab neighbours were also well aware of their own perception. They had begun the war in an attempt to restore not only lost territory but also their dignity in the public eye after the humiliating defeats of the 1967 war.

In Damascus and Cairo, however, it was the military class that went to war. Civilians mostly continued on with their daily lives and normal routines. Information was slow to reach them through heavily monitored media outlets, and security services ensured that the chatter on the streets was centred on debates over the best restaurants or neighbourhood gossip rather than political and military matters.

Both Anwar Sadat and Hafez al Assad also delivered fiery speeches in front of their legislative assemblies declaring triumphant action and brotherhood. But even within this military class itself, there was considerable disagreement. As the Israelis counterattacked, Anwar Sadat refused to allow his troops to withdraw to reinforce weaker positions, despite the suggestions of his generals. He feared that any reversal would be perceived as a retreat. It was these seams and weak points, like the gap between the two Egyptian armies on the eastern bank of the canal, that the Israelis were able to penetrate.

Additionally, some later speculated that Anwar Sadat had intended to use the capture of Suez as a mere bargaining chip to secure better terms in negotiations with Israel. Syria intended to save face at home as well. After fighting ceased, Colonel Rafik Halawi, whose infantry brigade had collapsed and allowed the Israeli advance, was executed. However, the short war would have even broader consequences into the future than these.

Egyptian POWs return home following the ceasefire after the war

A bipartisan committee concerning the war meets in Washington, DC, on 10 October 1973, just four days after it began

23 October

Israel ignores the ceasefire and cuts off the Cairo-Suez highway reaching the port of Adabia. The Egyptian Third Army is under siege. The UN Security council responds by insisting on the ceasefire and dispatches UN observers in the region. The new ceasefire starts at 7am the following day.

24 October

Israeli forces ignore the new ceasefire and move into the city of Suez, but are driven away by a small militia. 80 Israeli soldiers are killed and 120 wounded. The Soviet Union reacts by threatening to send troops to support the Egyptians while US responds by putting nuclear forces on alert.

25 October

For 24 tense hours, the world teeters on the brink of war with two great nuclear powers. The UN issues resolution 340, its third in less than four days.

28 October

Israeli and Egyptian military leaders General Aharon Yariv and General Mohamed el-Gamasy meet in a tent to negotiate a new ceasefire. It is the first meeting between military reps from both countries in 25 years.

Israeli pilot Shimshon Rozen climbs into his American F-4 Phantom II jet, which saw extensive action over the Golan Heights

Fallout

The end of the 1973 war signalled the beginning of the end for the pan-Arabism project, and Nasser's dream of a united Arab world crumbled. The Muslim Brotherhood, who saw Sadat as a traitor for suing for peace with Israel, began to rise in prestige on the Egyptian streets as the opposition to the status quo, rather than the USSR. On 6 October 1981, while officiating a military parade commemorating the 1973 war, Anwar Sadat was assassinated by a militant linked to the Egyptian Islamic Jihad. The ensuing power dynamic would shape his successor Hosni Mubarak's dictatorship, the Arab Spring and Egyptian politics into the modern day.

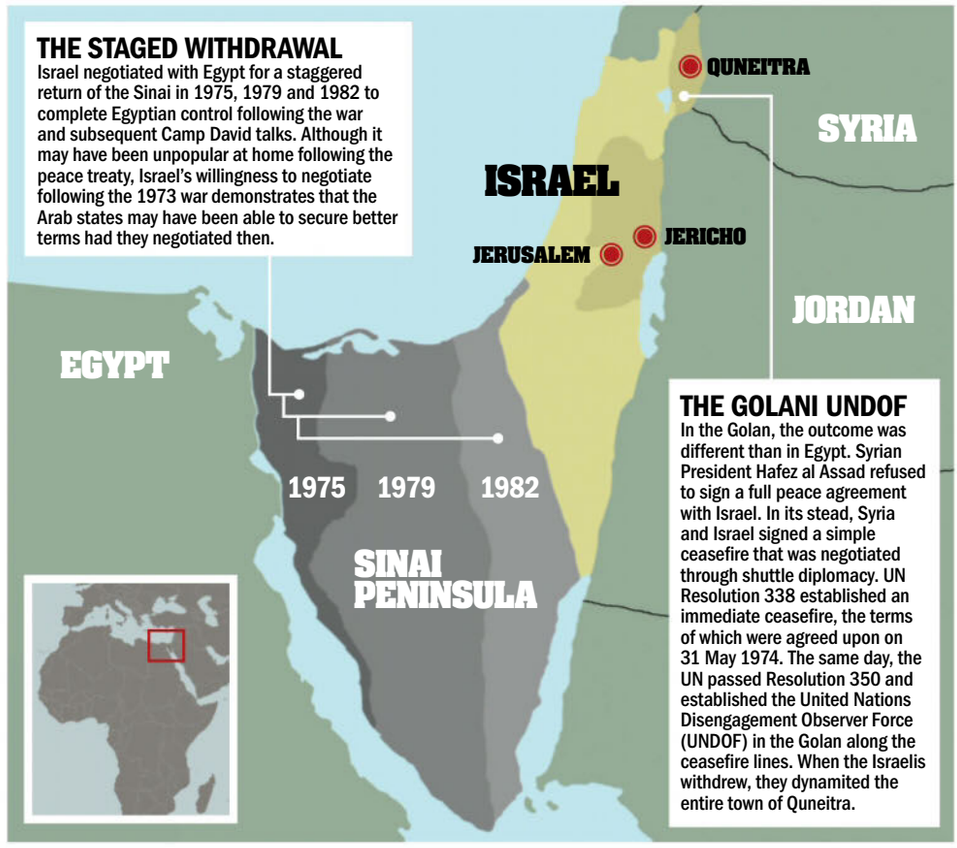
Israel was the clear winner of the war, despite the setbacks it had incurred. After the conflict, the United States brought two of its earlier enemies, Egypt and – later – Jordan, to the negotiating table.

Despite this, the 1973 war was the last direct conventional military confrontation between Israel and its Arab neighbours. After the unexpected success of the initial Egyptian and Syrian attacks, Israel saw that military conflict might not always end in its favour. Israel's standing grew in the eyes of the American public, who they saw as being locked into a battle between David and Goliath. Likewise, Egypt's inclination towards negotiation increased its positive perception as well. Syria was left marginalised as the sole state that refused to enter negotiations with Israel or capitulate.

After the ceasefire, the US was able to expand its influence in the region by gaining allies and making the climate more favourable for negotiations for Israel. Ultimately, the war led to the 1978 Camp David Accords between Sadat and Menachem Begin by US President Jimmy Carter, and, subsequently, to the 1994 peace agreement between Jordan's King Hussein and Yitzhak Rabin conducted by President Bill Clinton. It also led to the attempt at the Oslo agreements with the PLO and Israel.

This domino effect, starting from the end of the 1973 war, left behind the ambience for the current uneasy peace that has prevailed ever since – a drama to be played out in the halls of power, the UN, and the negotiation table rather than on the battlefield.

THE FINAL OUTCOME OF THE 1973 WAR



November

Arab oil-producing nations announce a cut in oil production, sending Western markets into a panic. The US sees record high oil prices and begins to consider new strategies for foreign oil and interests in the region. Within four months, the Arab oil-producing states will end the embargo.

9 November

Kissinger and the US secretary of state hold a meeting with Sadat in Cairo. Two days later, Israelis and Egyptians sign a ceasefire agreement that guarantees daily convoys of non-military supplies to Suez and the Third Egyptian army. POWs from both sides are exchanged.

1 January 1974

Kissinger meets with Sadat in the Egyptian city of Aswan. The next day he goes to Tel Aviv and negotiates a disengagement between Egyptian General Mohamed el-Gamasy, the Egyptian chief of staff, and his Israeli counterpart, General David Elazar.

19 February 1974

Anwar Sadat holds a ceremony in the Egyptian parliament to decorate Egyptian forces as Israel begins its withdrawal. Israel keeps control of the Sinai Desert for now.

6 June 1974

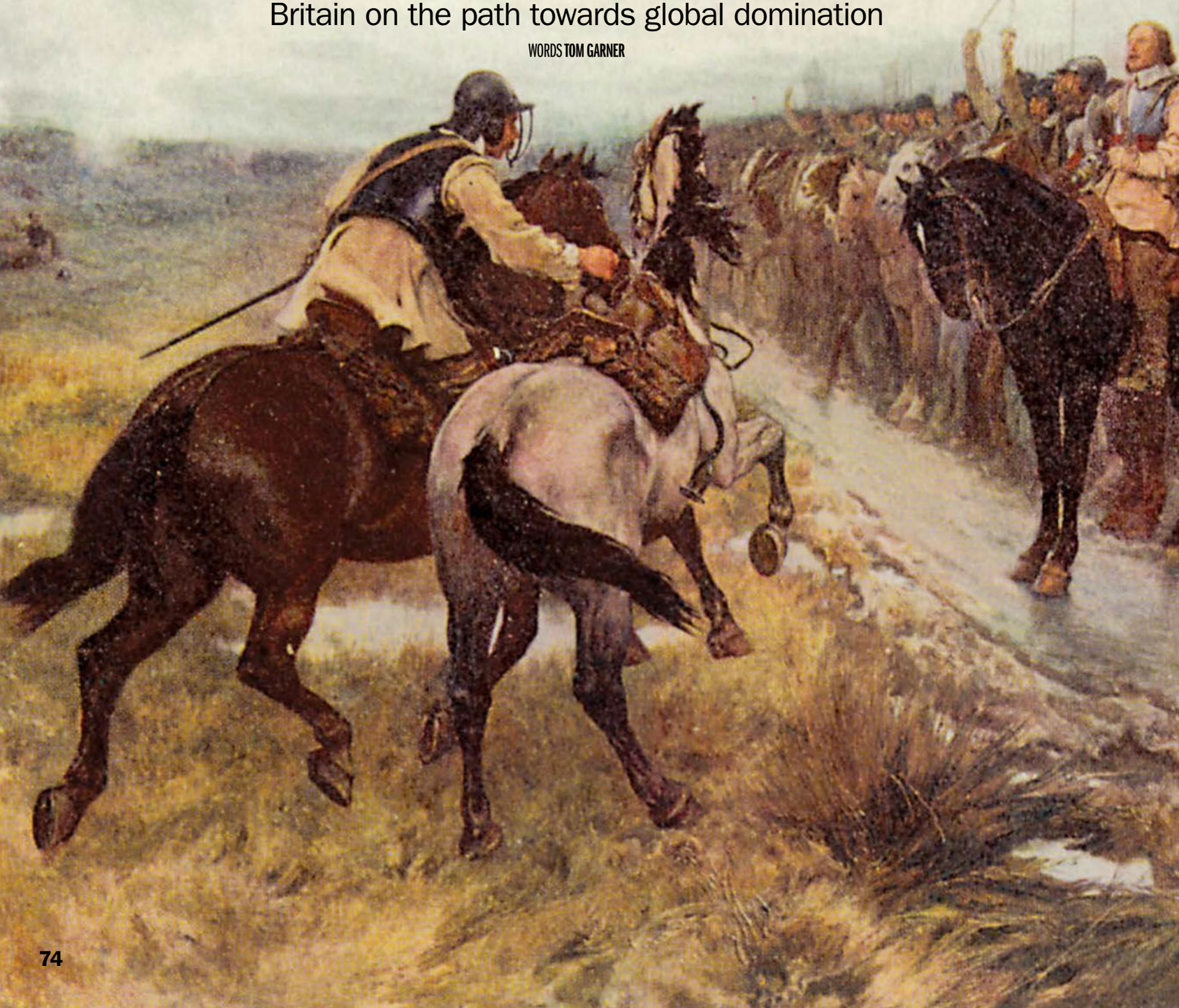
Israel, in agreement with a ceasefire with Syria, pulls out of Quneitra in the Golan. However, it destroys the town with dynamite. Syrian authorities leave the town in ruins as a monument.

Images: Alamy, FreeVectorMaps

THE NEW MODEL CROMWELL'S REBEL ARMY

This first professional standing army conquered all before it, launching Britain on the path towards global domination

WORDS **TOM GARNER**



In the 1640s, people of all classes were embroiled in a grim struggle over a fundamental question – who was the supreme power in the land, the king or parliament? The British Civil Wars raged for a decade and became a cataclysmic struggle for England's soul. It was also a conflict that would engulf Wales, Scotland and Ireland with devastating consequences. The resulting chaos saw the execution of a king and the establishment of a republican Commonwealth. Two things were largely responsible for making this radical change possible. One was an obscurely born MP from Huntingdon called Oliver Cromwell; the other was the most innovative military force of the age – the New Model Army.

When Charles I declared war on 22 August 1642, the Royalist and Parliamentarian armies were evenly matched – both amateur in attitude and performance, particularly regarding their commanders. On the Royalist side, Prince Rupert of the Rhine was an experienced soldier but also hot-headed and unable to control the cavalry under his command. During the first major battle of the war, at Edgehill on 23 October 1642, the Royalists nearly won the day having broken through the Roundhead lines with a cavalry charge. However, this breakthrough was not properly followed up as Rupert's cavalry charged away from the battlefield to loot nearby villages – the end result was stalemate. Similarly, Parliamentarian forces were at first commanded by ineffectual aristocrats such as the Earls of Essex and Manchester, whose field strategy was timid and lethargic. This meant there was no decisive battle for the first two years of the war. Oliver Cromwell observed these circumstances from the sidelines with frustration, and resolved to change the situation to parliament's advantage.

Already in his 40s when the war broke out, and without any military training, Cromwell was an unexpected innovator determined to reorganise parliament's army. His personal strength stemmed from his religious fervour. In an age where religion dictated everything, Cromwell was a zealot, seeing the hand of God in everything. This enabled him to be a supremely confident commander who was willing to take risks. In 1643, he formed his own cavalry regiment in Huntingdon, initially known as the Army of the Eastern Association

Dunbar 1650. This remarkable battle saw the New Model Army completely rout a Scottish force twice its size

"The British Civil Wars raged for a decade and became a cataclysmic struggle for England's soul"

but remembered by history as the 'Ironsides'. This force was at first composed of determined Puritan farmers, deliberately chosen for their strict religious resolve. Cromwell's training of his Ironsides made him stand out against other commanders, particularly his Royalist counterparts. He followed the common practice of arranging his cavalry in three ranks, while leading them forward for impact rather than firepower. However, he also encouraged his troops to charge in close formation, riding knee-to-knee – a tactic already familiar in Europe, but entirely new to English shores. Cromwell quickly became an ambitious professional soldier and his Ironsides an asset on the battlefield.

Cromwell's cavalry played a notable part in the Parliamentarian victory at the Battle of Marston Moor on 2 July 1644. Unlike their Royalist counterparts, the Ironsides stayed on the battlefield after their initial charge and attacked the Royalist infantry. This show of discipline secured the north of England for parliament and sealed Cromwell's reputation. Nonetheless, the army was still commanded by incompetent nobles who did not follow up Marston Moor with similar victories, much to Cromwell's frustration. After the Earl of Manchester failed to chase Charles I to Bath at the Second Battle of Newbury, Cromwell decided that the existing commanders had to be replaced by professionals. He was not alone in this view – another Roundhead commander, Sir William Waller, wrote to parliament stating: "Till you have an army merely your own that you may command, it is in a manner impossible to do anything of importance."

In early 1645, the 'New Model Ordinance' was passed, which encompassed a total reorganisation of parliament's army. This new force was to have 22,000 men in which there would be 12 regiments of foot – 1,200 men in each section. Each regiment would contain two-thirds musketeers and one-third pikemen. Additionally, there would be 11 cavalry regiments, one regiment of dragoons and an artillery train of 50 guns. The highly experienced Sir Thomas Fairfax would command the army and Philip Skippon the infantry.

In April 1645, Cromwell forced through the 'Self-Denying Ordinance' bill, preventing MPs in the House of Lords and Commons from holding military positions. Essex and Manchester resigned, but Cromwell, as MP for Cambridge, was considered too important and so kept his command. Fairfax made Cromwell the commander of the cavalry, with the Ironsides forming the nucleus of parliament's force. The New Model Army was born.

Cromwell and Fairfax quickly developed the New Model into an efficient force. In a unique move for the period, officers were appointed and promoted on merit rather than social standing. Like Colonel Pride, a former brewer, these officers also often came from humble origins. Discipline was strictly enforced but soldiers were compensated with regular pay. Infantrymen were paid eight pence a day while the cavalry received two shillings, as they had to supply their own horses and pay for their upkeep. The New Model's structure was also well organised. Officers undertook specific duties, such as the administration of justice and the acquisition of supplies. These tasks were performed nationally and under a unified command. By contrast, the Royalists were hindered by factional infighting at Charles I's court in Oxford, where key decisions often ended in confused squabbling.

***Right:** Sir Thomas Fairfax was the talented first commander-in-chief of the New Model Army. The decisive Battle of Naseby was won under his command*

Key to the strength of the New Model was its highly religious outlook. Cromwell believed that military victory was the outcome of God's will. He wanted the army to "valiantly fight the Lord's battle" as "an army of saints". To that end, recruits were drilled using a book called *The Soldier's Catechism*. This instilled the troops with a sense of divine mission. One of the first questions in the book asked: "What are the principal things required of a soldier?" The answer was: "That he be religious and Godly." Additionally, the men were encouraged to be honest, principled, politically motivated and sober. They were fed propaganda that the

"This show of discipline secured the north of England for parliament and sealed Cromwell's reputation"

***Left:** Oliver Cromwell. MP for Cambridge and militant Puritan. Cromwell was chiefly responsible for the success of the New Model Army*

Cromwell's Ironsides were instrumental in the Parliamentarian victory at Marston Moor in 1644

THE ORIGINAL REDCOATS

Parliament's elite soldiers were the first to officially wear the uniform soon to be known the world over

MORION HELMET AND BREASTPLATE

These two items were designed for pikemen and were intended to be pistol proof. It was a different helmet, with the 'lobster pot' design, that became an iconic symbol of the Ironsides.

MATCHLOCK MUSKET

This was the standard firearm used by western European armies in the 17th century. They were clumsy and dangerous pieces of equipment with a very slow reloading time. Muskets were best used when fired in a volley.

This pikeman officer is seen wearing a helmet similar to those famously used by the Spanish conquistadors

GUNPOWDER FLASKS

These wooden containers were designed for musketeers and were effectively a 'shot in a box'. Each flask contained a musket ball and enough gunpowder to fire one round. They were made of wood rather than paper both to protect the round and to speed up the loading time.

The British redcoat is a legendary figure in military history, a symbol of the all-conquering power that helped create and maintain the British Empire. Though even today British soldiers wear red coats for ceremonial occasions, they originated in the fires of civil war.

During the early years of the British Civil Wars, specific regiments on both sides wore coloured uniforms. For example, on the Royalist side there were regiments of 'whitecoats' and 'bluecoats'. However, there were no specific colourings for whole armies, so individual soldiers usually wore their own clothes. During a battle, the opposing sides told each other apart by using 'field signs'. These could include coloured armbands or sprigs of wild plants pinned to hats. Of course, in the din and smoke of battle, it could be very difficult to tell apart comrades from enemies.

When the New Model was created, Oliver Cromwell concluded that the soldiers' equipment had to be standardised, as this would ease the logistical demands on campaigns – this included both weapons and clothing. Venetian Red was chosen as the colour of the official uniform as it was the cheapest dye available. This inexpensive quality fitted in well with the Puritan ethic of not appearing to be ostentatious, although as the centuries went by the redcoat would become associated with dashing swagger and swooning ladies. Indeed, the redcoats of the New Model Army would not have appeared in the plush scarlet that is associated with today's Trooping of the Colour, but a muddy brownish-red tone.

The introduction of the redcoat seems to have had a positive effect on the troops and promoted solidarity among its often low-born but capable soldiers. Cromwell himself was proud of the meritocratic red-coated army he created and famously declared: "I had rather a plain russet-coated captain that knows what he fights for and loves what he knows, than that which you call a gentlemen, and is nothing else. I honour a gentleman that is so indeed."

"Though even today British soldiers wear red coats for ceremonial occasions, they originated in the fires of civil war"

Charles I's personal baggage was captured at Naseby, and Cromwell later published his letters from the Irish Catholic Confederation

Royalists were the complete opposite in their behaviour, being described as arrogant, drunk and pretentious. This was an army that stood apart from others in that it was specifically designed to aid a modern political and religious movement. The term 'New Model' was apt – nothing like it had been seen before. The pious passions of its soldiers would be the deciding factor in the outcome of the Civil War.

Within months of its creation, parliament's army gained its first major victory at Naseby on 14 June 1645. This battle showed the difference in discipline between the Royalists and Parliamentarians. Fairfax was the overall commander, but it was Cromwell's Ironsides that again tipped the balance in parliament's favour. After breaking many of the Roundhead horsemen, Prince Rupert could not prevent his cavalry from breaking away from the main battle in order to attack the Parliamentarian baggage train. This repeat blunder, reminiscent of Edgehill, contributed to the Royalist defeat. However, what was more essential to the Parliamentarian victory was Cromwell's disciplined command of his cavalry. Forbidden to leave the battlefield, instead the Ironsides smashed the Royalist centre before Rupert's cavalry returned and then remained on the field to consolidate their position. When Rupert eventually rallied his troops to return to the battlefield, they refused to attack the Ironsides.

"This was an army that stood apart from others in that it was specifically designed to aid a modern political and religious movement"

Naseby was a decisive triumph. Charles I's army was shattered and all its artillery and stores captured. The New Model Army's superiority was confirmed. Before Naseby, the Royalists had mockingly referred to parliament's reorganised army as 'The New Noddle'. Now they could no longer hope to win the war. Within a year, Charles surrendered and the First Civil War was won for parliament, thanks largely to the New Model Army.

However, parliament's victory did not end the conflict. In a sense, the New Model Army won its spurs at Naseby, but it would face many more battles in the coming years, and it was these encounters that would confirm the New Model's reputation as the era's pre-eminent fighting force. After Charles I's surrender, there was an extended period where parliament, the army and the Scots struggled to reach an agreement on how to settle the kingdom. Although Charles was a prisoner, he was considered crucial to the proceedings. The king was unco-operative and secretly negotiated with the Scots to invade England on his behalf. This sparked another civil war and a Scottish army crossed the border in July 1648. After a month of skirmishes, Cromwell marched north to confront it. The two armies met outside Preston in mid-August.

WINNING TACTICS AT DUNBAR

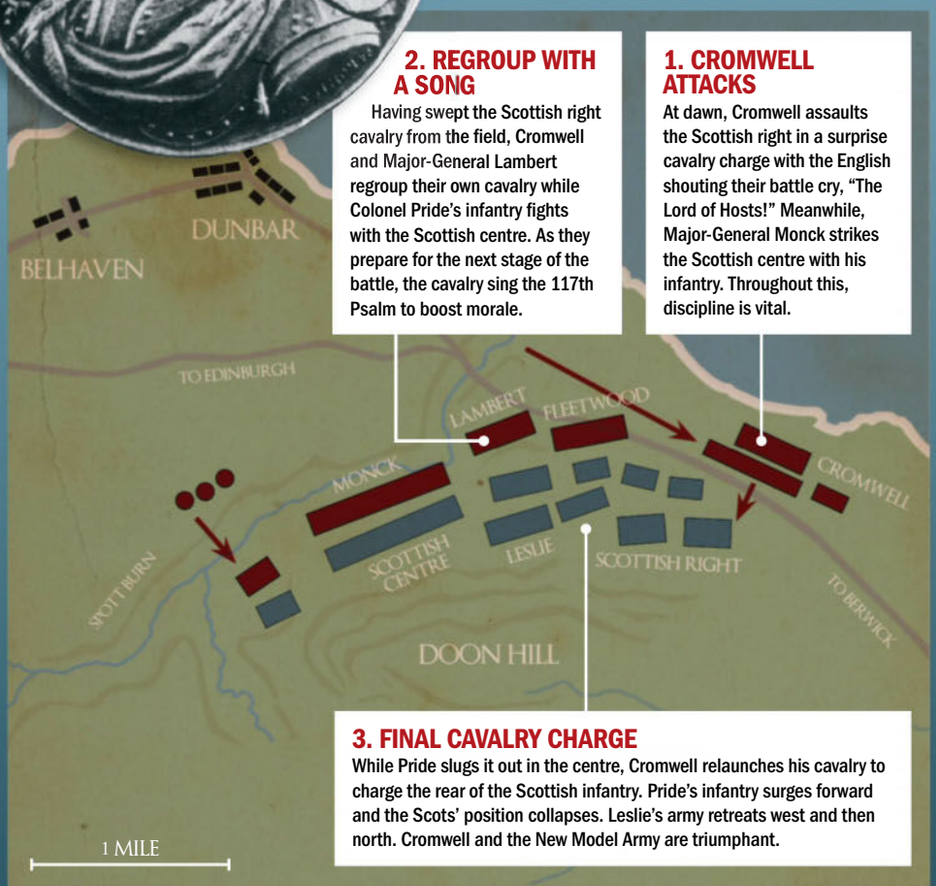
A tired and hungry New Model Army triumphed against the odds with the help of daring leadership and some rousing hymn singing

The Battle of Dunbar was arguably Cromwell's greatest victory. He had invaded Scotland with a veteran army of 15,000 men (10,000 foot and 5,000 horse) to pre-empt an invasion of England by Charles II. His army was supplied from the sea on the east coast of Scotland as the Scots had adopted a scorched-earth policy between Edinburgh and the border. By September 1650, the fatigued New Model Army started to retire to their supply base at Dunbar. However, the Scots got there first and blocked their path, positioning themselves on Doon Hill overlooking the Berwick road – the only route back to England.

The Scots were also numerically superior, some 22,000 men, and fighting on home territory. With some of his men suffering from illness, Cromwell was outnumbered almost two to one and with battle now the only option, even he acknowledged that the situation had turned desperate: "We are upon an engagement very difficult… the enemy hath blocked up our way… through which we cannot get without almost a miracle."

To add to Cromwell's misery, the Scots were commanded by David Leslie, a highly experienced soldier. Leslie and Cromwell had fought together at Marston Moor where the former had played an important part in the Parliamentarian victory. However, on 2 September, under pressure from the Scottish Kirk and parliament to attack, Leslie moved down from his commanding position on Doon Hill and towards Dunbar town to launch an attack on the English encampment. Cromwell immediately saw this mistake and decided to meet the challenge the next day, 3 September.

***Left:** The Dunbar victory medal, showing Cromwell's bust, was given to Parliamentarian soldiers that fought*



1. CROMWELL ATTACKS

At dawn, Cromwell assaults the Scottish right in a surprise cavalry charge with the English shouting their battle cry, "The Lord of Hosts!" Meanwhile, Major-General Monck strikes the Scottish centre with his infantry. Throughout this, discipline is vital.

2. REGROUP WITH A SONG

Having swept the Scottish right cavalry from the field, Cromwell and Major-General Lambert regroup their own cavalry while Colonel Pride's infantry fights with the Scottish centre. As they prepare for the next stage of the battle, the cavalry sing the 117th Psalm to boost morale.

3. FINAL CAVALRY CHARGE

While Pride slugs it out in the centre, Cromwell relaunches his cavalry to charge the rear of the Scottish infantry. Pride's infantry surges forward and the Scots' position collapses. Leslie's army retreats west and then north. Cromwell and the New Model Army are triumphant.

Parliament's army had to fight a large Scottish force of nearly 20,000 men, commanded by the Duke of Hamilton. By contrast, Cromwell only had 9,000 troops, and of those just 6,500 were experienced soldiers. Despite this, Cromwell's force was much more disciplined than the Scots, who additionally were spread out over 20 miles around Preston. This meant Hamilton couldn't communicate properly with his troops. The Scottish commander had placed his cavalry in the vanguard, while his infantry was left trailing behind traversing over boggy ground, which hampered their speed.

Cromwell saw these advantages, and on 17 August, attacked the infantry in the rear of Hamilton's army. However, the boggy ground also restricted the New Model's movement, particularly as it was reliant on the Ironsides for success. This left a brutal and bloody struggle for control of Preston, as Cromwell's troops clashed with the Scottish infantry.

At the end of the day, the fighting had cost the Scots 8,000 killed or captured. One action at the Ribble Bridge had seen hard fighting lasting more than two hours, but the battle was

The Battle of Naseby was the first test of the New Model Army and was a decisive victory in the First English Civil War

"England was declared a republican Commonwealth with the New Model Army acting as the enforcer of this new state"

not yet won and it continued again the following day. Cromwell had to invest Preston with a strong garrison and guards for the large number of prisoners. He now only had 3,000 infantry and 2,500 cavalry to fight the remaining 10,000 Scottish troops. Luckily for the English, Hamilton was experiencing his own problems – his men were exhausted, lumbered with wet ammunition, and many of the hungriest had gone to Wigan to plunder food. This enabled Cromwell to continually harry the Scots as they fought a disorganised retreat. Despite making some determined stands at various passes and bridges, Hamilton's army could not withstand the disciplined onslaughts from the Ironsides, and eventually what was left of the troops offered their surrender.

Once again the New Model Army had flattened Royalist hopes of victory, and this time parliament no longer accommodated the king. He was put on trial for treason against his own people, found guilty and publicly beheaded in Whitehall on 30 January 1649. Cromwell was one of the signatories to his execution and England was declared a republican Commonwealth with the New Model Army acting as the enforcer of this new state. Fairfax resigned his army command in protest against the king's death and Cromwell became commander-in-chief of the army.

Many others were also outraged by Charles's execution, particularly the Royalists and the Scots who had not been consulted about their monarch's fate. This anger found an outlet in Ireland, where English Royalists formed an alliance with Irish Catholic Confederates and Ulster Scots against the Commonwealth. So, in March 1649, parliament commissioned Cromwell to invade Ireland with the New Model Army. Leaving nothing to chance, he made sure the men, including some 12,000 veterans, were fully paid and equipped before setting sail. His Irish campaign would be of a different nature to the ones that came before and after. Instead of decisive battles, the army would engage in a series of sieges that would whittle down Irish resistance.

For Cromwell, it would be a militarily brilliant campaign, but also one marred by controversy. His tactics centred around massive artillery bombardments of fortified towns and speedy marches to surprise neighbouring garrisons. To save time and men, he would issue generous surrender terms, but if the garrison refused to comply, he used shock tactics to persuade others that capitulation was the best option against the advancing force.

The most notorious of these incidents occurred at the Sieges of Drogheda and Wexford, though militarily both these were notable successes for Cromwell. At Drogheda, artillery was used to concentrate firepower into the breaches and Cromwell personally rallied his troops by leading them into the fray. Parliamentarian casualties were low, numbering about 150 men. Similarly at Wexford, Cromwell skilfully manoeuvred around the port and approached it from the south. This took the garrison by surprise as they were expecting the army to approach from the north. The town was quickly taken and the army captured ships, artillery, ammunition and tons of supplies. Once again losses were very low with casualties of 20-30 men.

"Despite the seemingly unstoppable force of the New Model Army in Ireland, it was also the only place where it suffered a serious beating"

What tarnished these successes were the massacres of enemy soldiers and civilians. During the storming of Drogheda, about 3-4,000 soldiers and civilians were killed, many of them in cold blood. Likewise at Wexford a similar number of Irish soldiers and civilians were dispatched. In both sieges, the massacres occurred when New Model troops went on a frenzied rampage after the towns were stormed. In 17th-century Europe atrocities such as this were tragically common.

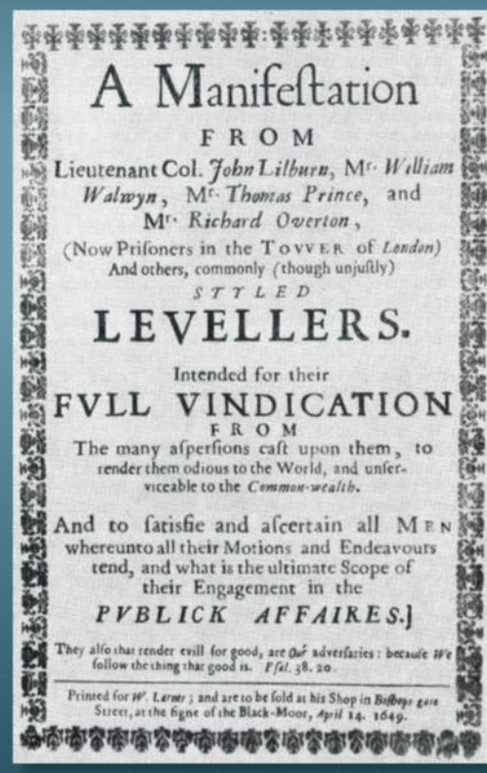
However horrific the massacres were, they did serve a purpose. Many Irish towns subsequently surrendered to Cromwell out of fear, not just of the New Model's military prowess but also to prevent further loss of life. This saved Cromwell time and supplies in conducting drawn-out sieges. He also showed strategic foresight over the following winter in 1649-50. The season was unusually mild and the army used this to procure supplies of fodder for its horses and draught animals. This allowed Cromwell to renew operations at the end of January 1650, rather than having to wait for the spring.

Despite the seemingly unstoppable force of the New Model Army in Ireland, it was also the only place where it suffered a serious beating. At the Siege of Clonmel in May 1650, Cromwell attempted his usual tactic of storming the town after an artillery bombardment. However, unknown to the army, the breach was internally surrounded with an enclosed area that was filled with Irish cannon and musketeers. Two assaults by New Model troops ended in disaster. On both occasions, the English became trapped and eventually 1,500-2,500 soldiers were killed. This was the New Model's

REVOLUTIONARY ARMS

The New Model was a hive of political dissent calling for democratic rights 150 years before the American and French Revolutions

The meritocratic nature of the army encouraged grassroots political activity that was unprecedented and strikingly forward thinking. Common soldiers known as 'Agitators' were elected in 1647 to demand unpaid wages from parliament, but when this was refused, they arrested the imprisoned Charles I to use him as a bargaining tool against the army 'Grandees' such as Cromwell. By this time, Agitators were co-operating with Levellers – who believed in an extended franchise, individual rights enshrined in a written constitution and a government answerable to the people, not the king. Cromwell agreed to discuss the issues at the Putney Debates in October 1647, where many soldiers passionately argued for universal democratic rights. Colonel Rainsborough famously declared: "I think that the poorest he that is in England hath a life to live, as the greatest he. I think it's clear that every man that is to live under a government ought first by his own consent to put himself under that government." The Grandees rejected many of these demands, which fuelled further discontent. In 1649, Leveller mutinies broke out in the army and were brutally crushed. The radical ideas that were espoused by the army rebels were never forgotten and heavily influenced later revolutions.



A Manifestation
FROM
Lieutenant Col. *John Lilburn*, Mr. *William Walwyn*, Mr. *Thomas Prince*, and Mr. *Richard Overton*,
(Now Prisoners in the TOWER of *London*)
And others, commonly (though unjustly)
STYLED
LEVELLERS.
Intended for their
FVLL VINDICATION
FROM
The many aſperſions caſt upon them, to render them odious to the World, and unſerviceable to the *Common-wealth*.
And to ſatisfie and aſcertain all MEN whereunto all their Motions and Endeavours tend, and what is the ultimate Scope of their Engagement in the
PVBLICK AFFAIRES.]
They alſo that render evill for good, are *Our* adverſaries: becauſe *We* follow the thing that good is. *Pſal.* 38. 20.
Printed for *W. Larner*; and are to be ſold at his Shop in Bishops gate Street, at the ſigne of the Black-Moor, *April* 14. 1649.

***Above:** A Leveller manifesto published in 1649. John Lilburne was an Ironside veteran of Marston Moor*

first major setback and its greatest loss of life sustained in a single action. Nonetheless, the Irish had also suffered and abandoned the town having lost several hundred men.

Cromwell left Ireland soon afterwards but his remaining troops carried on the systematic conquest of the country, with the whole island eventually being subjugated.

After many negotiations, Charles II sailed to Scotland and was proclaimed king. This presented a genuine threat to the Commonwealth and Cromwell subsequently invaded Scotland to prevent a Scottish invasion into England. After the miraculous New Model victory at Dunbar in September 1650, the Royalist cause looked lost. Nonetheless, Charles II was crowned king of Scots on 1 January 1651, and later in the year he led a last-ditch invasion of England to regain his throne. This was against the advice of David Leslie, the defeated commander at Dunbar. In August 1651, 14,000 Scottish troops crossed the border. Cromwell, who was still reducing Scotland, followed Charles and collected reinforcements as he proceeded south. The New Model Army caught up with the invading army at Worcester on 3 September. By this time, Cromwell's force numbered 28,000 regular troops and 3,000 militiamen. This was the first occasion when the New Model Army had overwhelming numerical superiority over the enemy and Cromwell was at the peak of his confidence.

The Battle of Worcester took place in a wide area around the city. Cromwell attempted to encircle Worcester in order to force Charles into a defensive position within its walls. However, to the south and south west of Worcester, the Rivers Severn and Teme blocked the army's advance. These would need to be crossed in order to carry out the battle plan, so Cromwell began the fight by personally leading three brigades to attack the pontoon bridge on the River Teme. Once the north bank had been taken, the Scots collapsed back towards Worcester itself. While Cromwell was crossing the rivers, the east flank of his army was threatened when Charles II rallied his troops to sally out of the town and assault the New Model infantry. This surprise attack was initially successful and there was a moment when the entire east wing of the army almost collapsed. However, Cromwell came charging back from his position on the River Severn to bolster his troops. The return of his brigades turned the tide of the battle and the Royalists were thrown back into Worcester.

At this point, parliament's Essex militia stormed and captured Fort Royal, which was a defensive entrance into the city. Once the guns

Charles II was forced to flee after defeat at the Battle of Worcester

— THE COLDSTREAM GUARDS —

Despite being one of the most prestigious regiments that protect the royal family, the Coldstream Guards are ironically revolutionary in origin

When Oliver Cromwell died in 1658, he was succeeded by his ineffectual son, Richard. This created a power vacuum, with some in the army wanting to restore parliamentary power and others seeking to restore the monarchy. The commander of the army in Scotland, George Monck, wished to preserve the stability of England and so marched his force across the Anglo-Scottish border at the Coldstream River and occupied London in February 1660. Monck then entered into secret negotiations with Charles II while parliament was re-elected. The new assembly was overwhelmingly pro-Royalist and Charles was restored in May 1660. The New Model Army was ordered to disband in conjunction with the Indemnity and Oblivion Act, which sought to reverse the effects of the Civil Wars, and the king's new army would be created from scratch.

Monck's regiment was allowed to be the last New Model outfit to disband, however, in January 1661, it was required to suppress an insurrection in London and the order for disbandment was repealed. On 14 February 1661, the regiment took part in a symbolic ceremony. On Tower Hill, the soldiers publicly put down their weapons as a unit of the New Model Army, before immediately being ordered to pick them up again as soldiers of Charles II's army. For a regiment that was created by Oliver Cromwell in 1650, this was quite a shift in identity. From 1670, the unit became known as the Coldstream Regiment of Foot Guards, in honour of the march that restored the monarchy. Today, the Coldstream Guards is the oldest regiment with continuous service in the British army and, along with the Blues and Royals, is the only unit that can directly trace its lineage to the New Model Army.

"The Coldstream Guards is the oldest regiment with continuous service in the British army"

The Coldstream Guards were originally formed in 1650 by Oliver Cromwell to defend the Republican Commonwealth of England

inside were taken, they were turned on the Royalists in the town itself. The final part of the battle then played out in fierce street fighting. Running skirmishes sparked out all over the city, and the Royalists eventually panicked and fled for their lives. Charles II was among those who fled, and after several legendary adventures in hiding, he eventually escaped to the continent.

The vast majority who followed him were not so lucky – 3,000 Scots were killed at Worcester and another 10,000 were taken prisoner, most of who were transported to the colonies as indentured slaves. For the New Model Army, the Battle of Worcester was a triumph, as well as the last major battle of the Civil Wars. The Parliamentarians had only lost 200 men on the field, which in a strange irony had seen among the first skirmishes of the Civil Wars back in 1642. Cromwell described Worcester as a "crowning mercy" and it was to be his final battle as an active commander. Nevertheless, the New Model would continue as the backbone of the Commonwealth throughout the 1650s, achieving a last hurrah in the dying days of Cromwell's Protectorate, at the Battle of the Dunes.

Taking place on 14 June 1658, the Battle of the Dunes earned a victory for the combined Anglo-French army commanded by the Vicomte de Turenne against the Spanish. Cromwell had agreed to form an alliance with the French in order to put pressure on the exiled Charles II and acquire the Channel port of Dunkirk by diplomatic means. France was at war with Spain and Dunkirk itself was part of the Spanish Netherlands, which meant it would need to be taken by force. Turenne besieged Dunkirk with 15,000 troops, of which 3-4,000 were red-coated soldiers of the New Model Army. A Spanish force of 15,000 men was sent to relieve the town, about 2,000 of which were English Royalists led by the Duke of York, the future James II. The battle was a miniature replay of the Civil Wars re-created on a European stage.

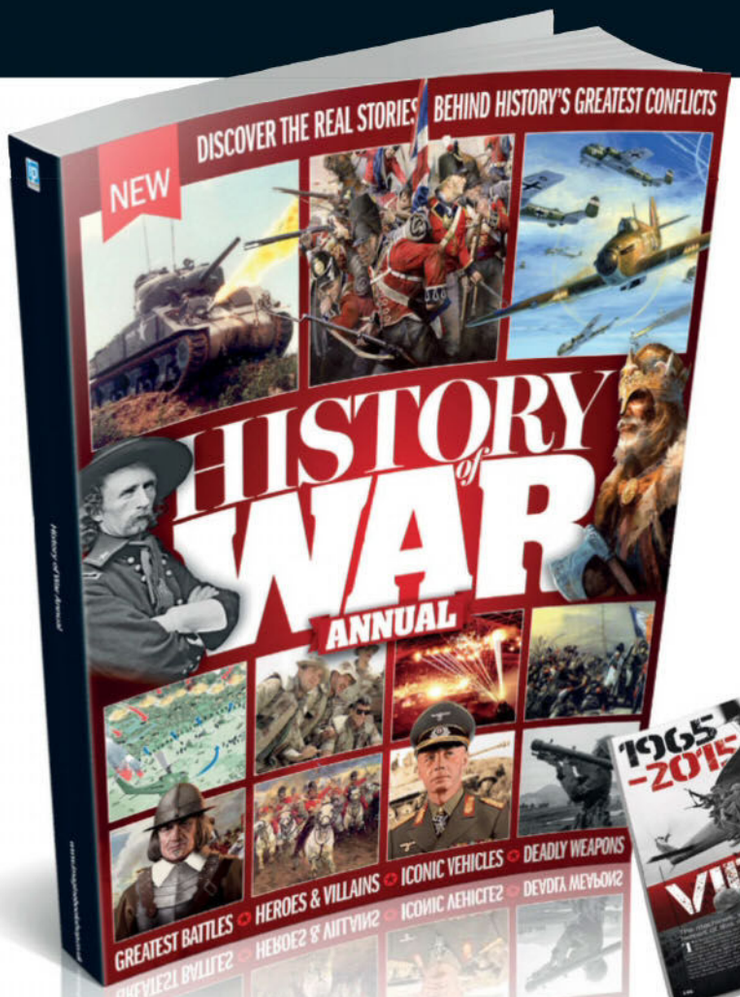
The battle played out on coastal sand dunes that lay north east of Dunkirk. Turenne took the initiative and attacked the Spanish entrenched in strong defensive positions among the dunes. English Major-General Thomas Morgan and Sir William Lockhart commanded the New Model contingent – it was Lockhart's Regiment of Foot that particularly distinguished itself. They astonished both the French and Spanish with the ferocity of their assaults against enemy positions. In particular, Lockhart's regiment launched a dramatic attack on a Spanish-held sand hill that was 150 feet high. The speed of the English attack took the hardened Spanish veterans defending the hill by surprise, and after a tough fight, the French came to support the English and the Spanish were driven away. Soon afterwards, the battle was decisively won for the Anglo-French army.

Dunkirk fell and was gifted to the English, but more importantly for the Protectorate, it also prevented the restoration of Charles II for another two years. The Battle of the Dunes demonstrated to the European powers that the New Model was one of the best fighting forces on the continent – one that would make England a power to be feared and respected.

The triumphant Vicomte de Turenne at the Battle of the Dunes

"They astonished both the French and Spanish with the ferocity of their assaults against enemy positions"

From the makers of HISTORY of WAR



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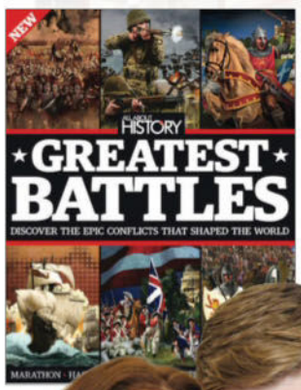

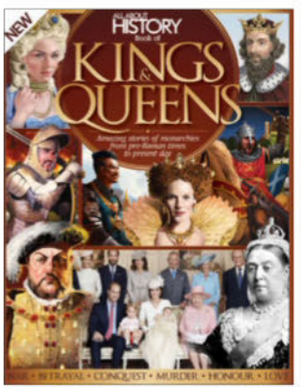

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PANAVIA TORNADO

Europe's multi-role workhorse has stood the test of time to serve in more than five decades of combat

WORDS & IMAGES **NEILL WATSON**

***Right:** A crew of two and supersonic capability made the Tornado a superb weapons platform*

At the end of World War II, early generation jet technology was incorporated into stunning new designs, as jets including the AVRO Vulcan, Gloster Meteor and American Lockheed T-33 replaced piston-engined aircraft. This early generation of jet engine technology was advancing at a very high rate. Together with advances in aerodynamic features including swept wings, plus the growing threat from Russia, these early jets were soon out of date. Several nations realised the next generation of fast jet was going to be extremely expensive to develop.

During the 1960s, the UK's Royal Air Force, together with other global air forces, began to look to the future and their requirements for fast jet warfare. The RAF's Buccaneer and AVRO Vulcan would eventually need to be replaced. Britain, having controversially cancelled the pioneering TSR-2 project and rejected the American F-111 as unsuitable, continued to search for a solution. Germany, Italy, the Netherlands, Canada, and Belgium all needed to find a replacement for the ageing, early generation F-104 Starfighter.

"COMPANIES FROM BRITAIN, GERMANY, ITALY AND THE NETHERLANDS FORMED A JOINT COMPANY CALLED PANAVIA TO DEVELOP AND MANUFACTURE THE NEW JET"

Right: *The Tornado's versatile external weapon carrying ability gave it true multi-role capability*

Right: *The three sections of the Panavia roundel represent the colours of the British, German and Italian flags*

PANAVIA TORNADO

CREW: 2
LENGTH: 16.72M (54FT 10IN)
WINGSPAN: 13.91M (45.6FT) AT 25° WING SWEEP, 8.6M (28.2FT) AT 67° WING SWEEP
HEIGHT: 5.95M (19.5FT)
WING AREA: 26.6M^2 (286FT^2)
LOADED WEIGHT: 20,240KG (44,620LB)
POWERPLANT: 2 x TURBO-UNION RB199-34R MK 103 AFTERBURNING TURBOFANS
MAX SPEED: MACH 2.2 (2,400KM/H, 1,490 MPH) AT 9,000M (30,000FT)
RANGE: 1,390KM (870MI)

DESIGN

Each nation had a pressing need to replace old airframes, but all had diverse requirements, so the decision was taken to jointly develop a multi-role aircraft capable of being adapted for use across several capabilities ranging from low-level ground attack to high-altitude precision bombing, and also as an interceptor/fighter. Canada withdrew for political reasons, as it was felt that the aircraft manufacturing would all be undertaken in Europe, while Belgium chose the French Mirage 5.

In 1968, the project was given the name MRCA (Multi Role Combat Aircraft), and the following year aerospace companies from Britain, Germany, Italy and the Netherlands formed a joint company called Panavia to develop and manufacture the new jet.

Variable geometry wing technology was employed for the first time in a European project. The design enabled the wing to be swept forwards by the pilot to give low-speed lift and manoeuvrability for landing, but swept back for high-speed flight. The concept was invented at the end of WWII by Sir Barnes Wallis, the creator of the Dambusters' 'bouncing bomb', but no British aircraft manufacturer at the time employed it. The American F-111 flew with a variable wing first, with the Tornado subsequently using what was known as the 'swing wing' technology to fulfil its diverse requirements.

In 1971, the respective governments signed an agreement to develop a final design – a two-seat, twin-engined aircraft with switchable external payloads that could fly at very low level in poor weather and penetrate enemy defences to deliver a variable payload. Britain also wanted an interceptor version of the aircraft, which was subsequently introduced as the F2 and F3 with a longer nose section.

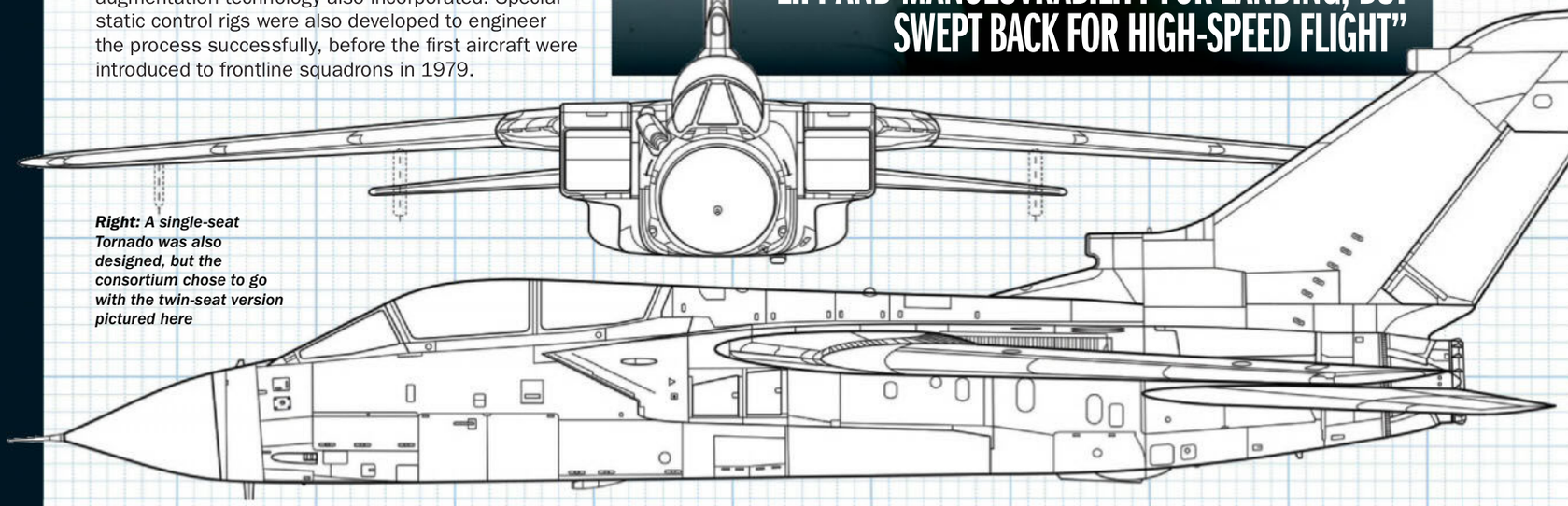
The first aircraft flew in August 1974, with development aircraft flying in 1976. The Tornado was an extremely difficult aircraft to produce from a basic design through to a final fighting aircraft due to the hugely changeable nature of the payload requirements and the variable wing technology. The aircraft had no internal bomb bay, as WWII bombers had, with all weapons and other payloads carried externally under the wings and fuselage.

As the wing swept back for high-speed flight, whatever weapons or external fuel tanks were fitted had to remain aligned with the centreline of the aircraft, plus as the wing moved back, it shifted the whole centre of gravity of the aircraft. Flight controls at that time were a mixture of electro-mechanical and hydraulic systems, with early-generation stability augmentation technology also incorporated. Special static control rigs were also developed to engineer the process successfully, before the first aircraft were introduced to frontline squadrons in 1979.

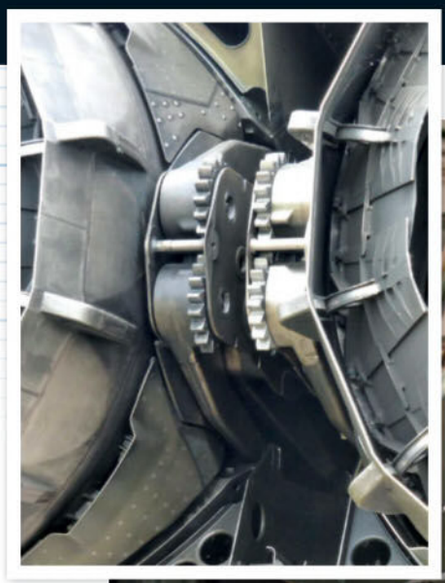
Afterburning jets developed by Rolls-Royce gave supersonic performance

Variable wing geometry was complex but gave good handling characteristics across wide speed ranges

"THE DESIGN ENABLED THE WING TO BE SWEPT FORWARDS BY THE PILOT TO GIVE LOW-SPEED LIFT AND MANOEUVRABILITY FOR LANDING, BUT SWEPT BACK FOR HIGH-SPEED FLIGHT"



***Right:** A single-seat Tornado was also designed, but the consortium chose to go with the twin-seat version pictured here*



Developed by Rolls Royce, the twin engines proved reliable and easy to service

***Inset above:** Afterburning engines inject fuel into the exhaust gasses*

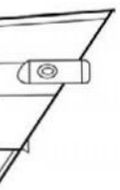
POWERPLANT

Rolls-Royce designed the RB199 engine specifically for the Panavia Tornado. Using technology and skills learned during the Corncorde airliner development, the new engine was test flown in a special pod beneath a test Vulcan bomber, in the same way that the Olympus engine had been for Concorde. The final engine design was manufactured in the same way as the aircraft – in a joint consortium of engine companies called Turbo Union that was made up of Rolls-Royce, Germany's MTU and Italy's FIAT Avio.

The engines employed a modular construction, which enabled in-service switching of engine modules without changing the entire engine. This gave improved efficiency, enabling aircraft to be quickly returned to service after receiving any damage.

Tornado aircraft flew with two RB199 engines, with at-the-time very advanced digital controls to reduce pilot workload. The engines had afterburner capability, where fuel is ignited into the exhaust system to give a massive increase in power for short periods. The engines also incorporated reverse thrust for improved braking performance when landing.

"THE ENGINES HAD AFTERBURNER CAPABILITY, WHERE FUEL IS IGNITED INTO THE EXHAUST SYSTEM TO GIVE A MASSIVE INCREASE IN POWER FOR SHORT PERIODS"



ARMAMENT

The very nature of its original design philosophy meant that Tornados across the different air forces carried remarkably diverse payloads. Under the main fuselage there were four light-duty and three heavy-duty 'hard points' for mounting weapons. Another four under-wing mounting points could carry 9,000 kilograms of bombs and other stores, ranging from long-range ferry tanks, short-range tactical fuel tanks that could be used supersonically, and air-to-ground and air-to-air missiles. Originally Two Mauser cannons were also mounted on the starboard side of the fuselage but one was removed in later variants.

A Tornado could carry any combination of AIM Sidewinder, ASRAAM, Maverick, Brimstone or even ALARM anti-radiation missiles for targeting insurgents using electronic devices. Bombs it could carry included Paveway, BL755 cluster bombs or even tactical nuclear weapons.

Additional uses for the mounting points included long-range fuel tanks plus external avionics pods including Rafael listening pods, laser targeting and Sky Shadow electronic countermeasures and jamming equipment.

The under-wing stores had to work in conjunction with the variable wing technology, but offered excellent versatility

Cockpit systems were upgraded several times across the life of the aircraft

***Right:** The pilot looked through a Head-Up Display (HUD)*

"THE COCKPIT WAS SPACIOUS, WITH ROOM ON THE MAIN INSTRUMENT PANEL AND SIDE PANELS FOR THE COMPLEX AVIONICS SYSTEMS"

The back seat crew member was responsible for tactics, navigation and weapons selection

COCKPIT

A crew of two both sat on Martin Baker Mk10 ejection seats. The seats were remarkably advanced and included integral personal equipment connectors for anti-G suits, oxygen supply, communications and air conditioning. The ejection seats had what is known as 'zero zero' capability, meaning that a trapped crew could escape from zero speed and zero height, all the way to 50,000 feet and 630 knots. The cockpit was spacious, with room on the main instrument panel and side panels for the complex avionics systems.

The pilot looked forwards through a Head-Up Display, which projected vital flight information onto the windscreen, meaning that they never needed to re-focus their view inside during combat. The rear seat crew member was responsible for the operation of the diverse weapons stores, assessing targets and threats, and also operated the advanced radar system housed in the nose behind the carbon composite cone.

Tornados were repainted in a low-visibility grey towards the end of the lifespan

"ITS VITAL ROLES IN VARIOUS CONFLICTS THROUGHOUT THE DECADES HAVE PROVED WHAT A SUPERB AIRCRAFT IT TURNED OUT TO BE"

IN SERVICE

Tornado aircraft have been operated by the Royal Air Force, Luftwaffe and Italian Air Forces throughout the life of the aircraft. Saudi Arabia also bought almost 100 Tornados to operate in the Middle East.

At several times throughout its life, the Tornado was scheduled for replacement. However, its vital roles in various conflicts throughout the decades have proved what a superb aircraft it turned out to be. Due to a combination of the aircraft's successes, its affectionate reception from flight crews, plus cost overruns and delays for replacements, Tornados have received an array of mid-life upgrades to ensure that some remain active today. In the 1990s, the Royal Air Force upgraded many of the original GR1 designated aircraft to GR4 specification.

The upgrades principally improved the aircraft's weapons and flight technologies. As digital systems advanced and GPS became the standard for positioning fixes, the aircraft were upgraded to the latest radar, flight and navigation systems. Even as late as 2005, Germany undertook further software and technology upgrades that enable Tornado aircraft to exchange tactical and radar information with other friendly aircraft while in combat.

The aircraft you see in these pictures was the pioneer aircraft for the GR4 upgrade programme. This aircraft was used to test and develop all of the new systems and software advances that were subsequently incorporated into frontline GR4 Tornados and is preserved by the Yorkshire Air Museum.

Despite being designed in the 1960s and of an age that may make other aircraft of the time suitable for museum display, the GR4 Tornado continued to fight as a frontline aircraft in 2015. The latest Eurofighter Typhoon still does not have the full capability for ground attack and support for ground forces that the GR4 is capable of. The GR4 has served in all of the recent and, indeed, current conflicts that require close support of ground forces and precision bombing capability against insurgents.

The main air forces that flew the Tornado are slowly phasing out the aircraft, but the process is proving to be an extended one. One of the reasons why the Tornado continues to be a vital aircraft is probably due to the original Cold War design. In a world where threats to nations take many different forms and require diverse capabilities of armed forces tasked with dealing with them, the Multi Role Combat Aircraft, as it was originally called in 1964, has proved to be very multi-role indeed.

Operated by several European air forces, plus Saudi Arabia, NATO exercises were often celebrated with unique colour schemes

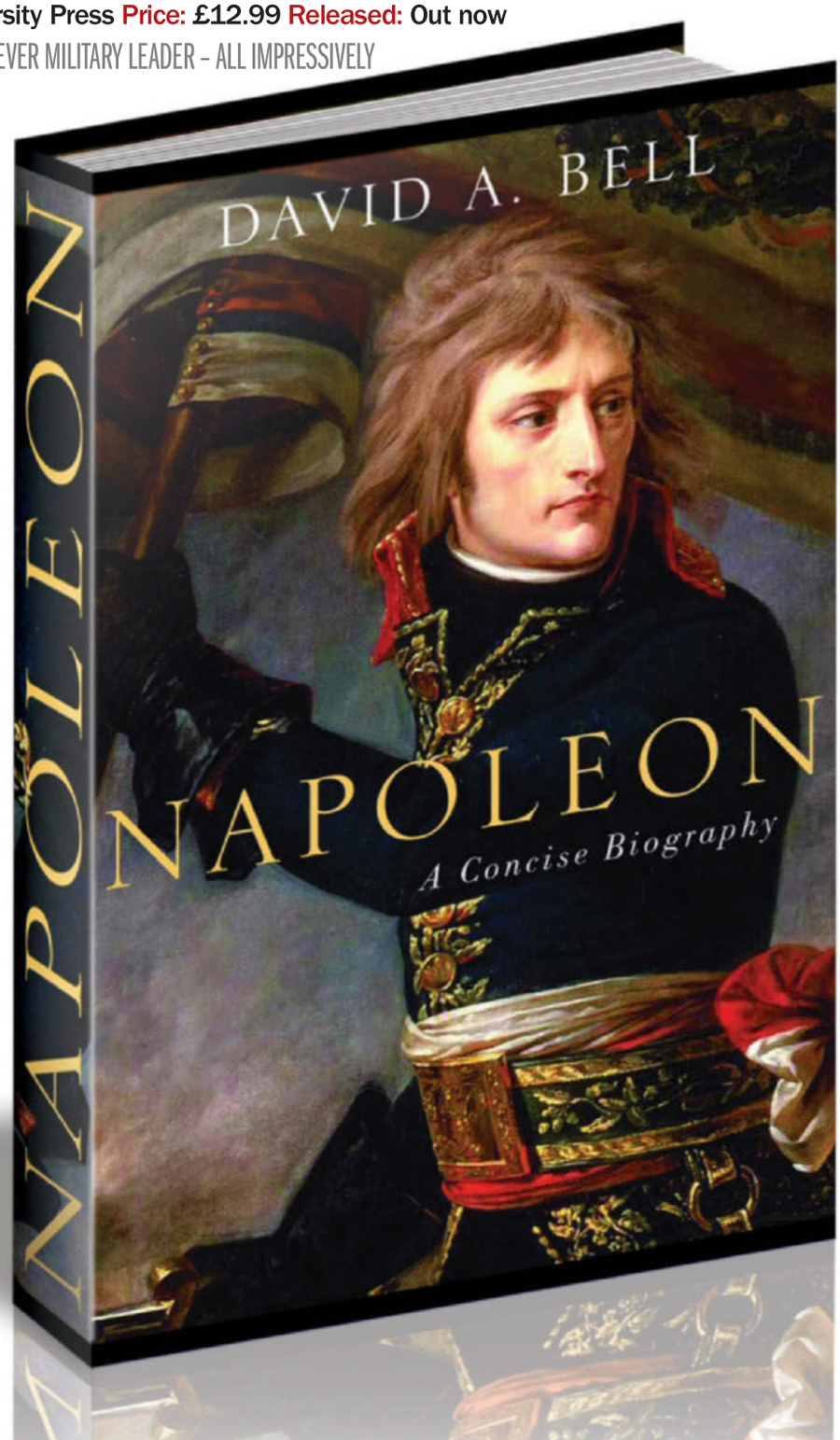
BOOK REVIEWS

Our pick of the newest military history titles waiting for you on the shelves

NAPOLEON: A CONCISE BIOGRAPHY

Writer: David A Bell **Publisher:** Oxford University Press **Price:** £12.99 **Released:** Out now

THE SPECTACULAR RISE AND FALL OF FRANCE'S GREATEST EVER MILITARY LEADER – ALL IMPRESSIVELY CRAMMED INTO AN ENTERTAINING 113-PAGE PACKAGE



Napoleon Bonaparte is one of the most written about figures in history. Last year alone, the 200th anniversary of his final defeat at Waterloo saw at least half a dozen books about him including the excellent *Napoleon The Great* by Andrew Roberts. Which raises the question: does the world really need yet another book about him?

According to author David A Bell, Bonaparte's latest biographer, the answer is yes because, as he points out, the subject appears so vast that only giant tomes on it seem to exist. So he's come up with a lively and, to use his term, concise study of a man who was at once both the greatest hero and villain of his age.

Therein lies Napoleon's great and continuing appeal, because he was a man capable of both great good, and great malevolence – a factor that pervades Bell's work. Reading this, there's an undeniable sense of Napoleon's enormous energy. He gushed out of the Enlightenment like an (almost) unstoppable, fast-flowing river of lava lighting up his age and literally setting the world ablaze in the process.

In his late 20s, he was already recognised as one of the greatest generals in European history. By his 30s, he was in total control of France. By the time he was in his early 40s, he ruled a pan-European empire the size of which had not been witnessed since the fall of Rome more than 1,000 years before. The wars he fought, and mostly won, helped spread revolutionary new ideas that ultimately changed the shape of the world forever. But they also brought death, misery and destruction to millions.

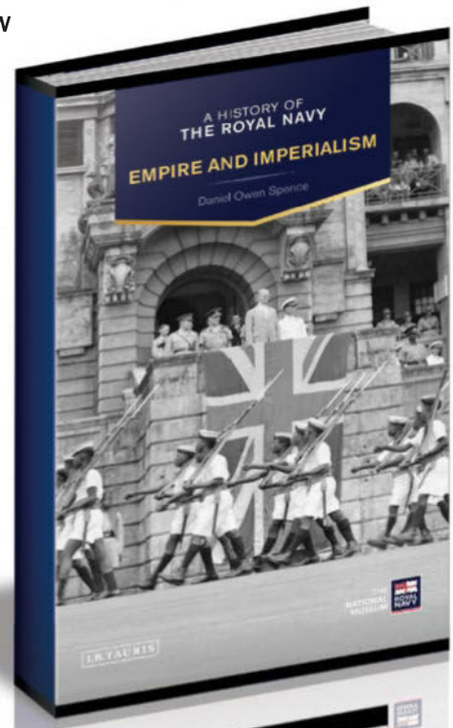
Bell's book explores all this with real verve, while also persuasively arguing that Napoleon must be seen in the context of the French Revolution. This seismic event in 1789 didn't just inspire Napoleon to become the shooting star of his age, it also empowered him. The revolution gave birth to a radically new form of warfare (essentially fast-moving, combined infantry, cavalry and artillery assaults) that Napoleon excelled in. It also brought about political changes that allowed Napoleon to wage wars on its behalf before finally allowing him to seize absolute power. Something that, in turn, gave him unprecedented access to resources – both human and material – with which to chase his wild ambitions.

Of course, it didn't end well for Napoleon and Bell is as good at describing his downfall as he is his remarkable rise. A succinct take on one of history's giants – perfect for Bonaparte beginners.

A HISTORY OF THE ROYAL NAVY: EMPIRE AND IMPERIALISM

Writer: Daniel Owen Spence **Publisher:** IB Tauris **Price:** £20 **Released:** Out Now

A CONCISE SUMMARY OF THE ROYAL NAVY AND ITS ROLE IN BRITAIN'S FORMER DOMINANCE



For centuries, the might of the Royal Navy enabled Britain to rule the waves and conquer vast swathes of the globe. However, it was so much more than an invasion fleet.

Owen Spence triumphantly explores how the most important arm of the largest empire in history contributed to the spreading of the values, laws and even sports of this small but ambitious island.

The cultural impact of the Royal Navy, both abroad and at home, is as fascinating as the many battles it waged to secure Britain's status as a global power. Spence recounts both with equal aplomb.

Francis Drake's famous expeditions of the 16th century preceded the real expansion of the empire in the 1700s as private companies sought to establish new trade abroad. The wealth they hoped to accrue could only be achieved through the prowess of a vast navy, a fleet in turn sustained by the wealth of these private interests and the riches it discovered in these new territories. The result of this rapid expansion, expedited during the era of Pax Britannica following the defeat of Napoleonic France in 1815, inspired a wealth of patriotic poetry, artwork and books. This fervour also spread abroad as colonial subjects judged themselves by their "Britishness".

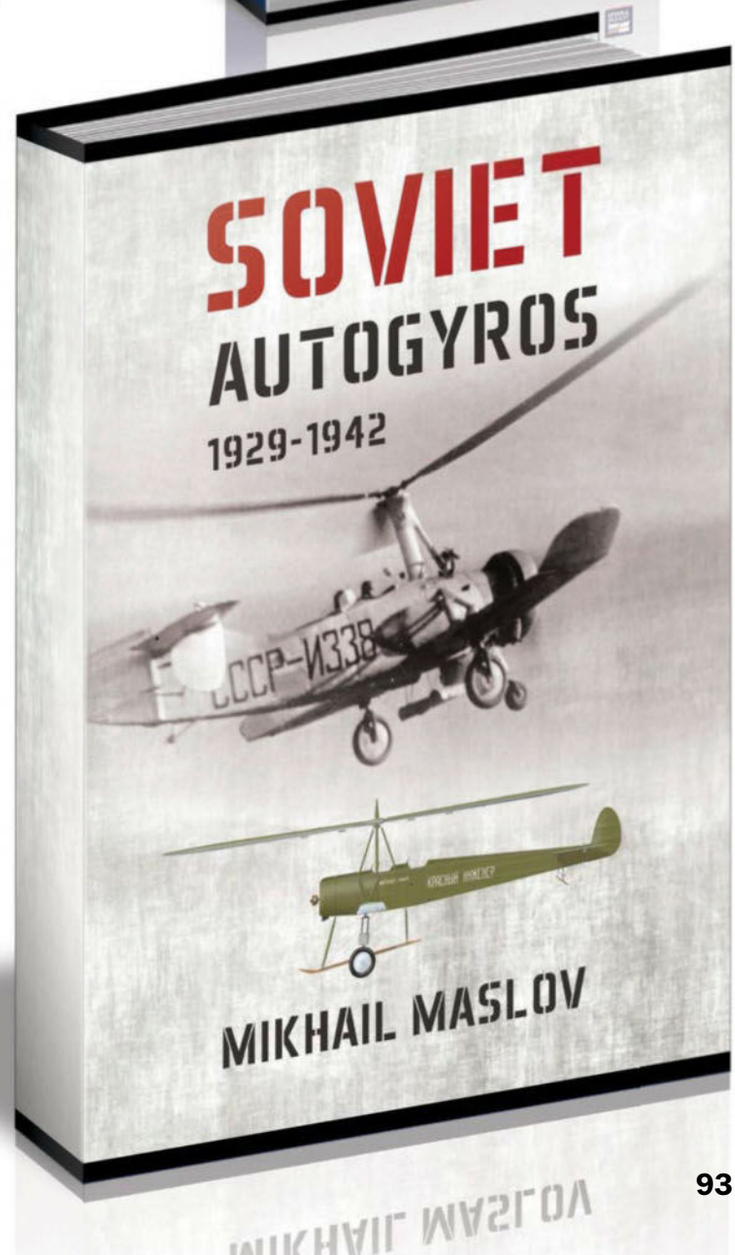
However, this faded through time as colonies such as India began to seek independence in the late 1940s, having rallied to Britain's call during World War II. Spence masterfully concludes his work by emphasising the intrinsic link between the Royal Navy's decline and the fading of Britain's global influence.

"THE CULTURAL IMPACT OF THE ROYAL NAVY, BOTH ABROAD AND AT HOME, IS AS FASCINATING AS THE MANY BATTLES IT WAGED TO SECURE BRITAIN'S STATUS AS A GLOBAL POWER"

SOVIET AUTOGYROS 1929-1942

Writer: Mikhail Maslov **Publisher:** Helion and Company
Price: £21.95 **Released:** Out Now

AN EXHAUSTIVE HISTORY OF THE EARLY SOVIET HELICOPTERS



As the title may suggest, this immensely detailed examination of the bizarre-looking autogyros created in the Soviet union before and during World War II may only attract the attention of the most fanatical students of aviation. Divided into two parts, Maslov's book spares no detail when praising the men of TsAGI Institute responsible for these flying oddities and the numerous variations they created. From the early 1-EA single-seat models to the first prototypes of the A-7 two seater first developed in 1931 (to which section two of the book is dedicated), the author goes to great lengths not to overlook a single machine.

Supported by fighter planes, but also equipped with their own defensive capabilities, the autogyros proved themselves to be a useful tool, particularly for spotting artillery, coming of age in the fight against the German invasion of Russia in June 1941.

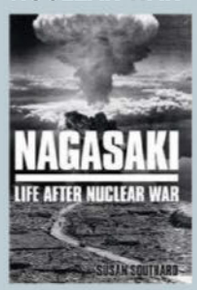
An increase in the number of autogyro flying courses at the outbreak of hostilities is testament to the Russians' faith in a contraption that helped lay the foundations for the development of modern helicopters.

While some of the text is so saturated in facts and measurements (from top speeds to rotor diameters) as to make it an endurance to read in parts, the level of dedication that Maslov lavishes upon his subject is admirable.

Some beautiful illustrations and photographs of the engineers, pilots and the autogyros themselves, occasionally in a state of ruin following a crash landing, add a welcome second dimension. After all, this is not a light read.

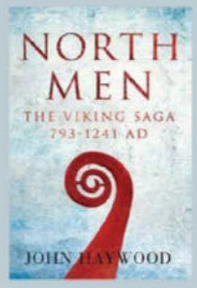
ALL ABOUT HISTORY RECOMMENDED READING

NAGASAKI: LIFE AFTER NUCLEAR WAR



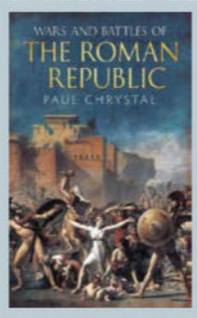
Focusing on the lives of five Nagasaki citizens affected by the atomic bomb, this book recounts the details of that fateful day as well as looking at the repercussions it had for the city, its people and the world. Miles away from previous drab accounts of the events in Nagasaki, the real-life stores keep you hooked from the start to the very end.

NORTH MEN: THE VIKING SAGA 793-1241 AD



Taking a path less travelled by not just beginning in Lindisfarne (although events here are covered), *North Men* looks at the evolution of civilisations in Scandinavia, with a sprinkling of mythology thrown in for good measure. In terms of Viking activity, Haywood aims to give the reader a full picture of the Viking age, charting all their exploits from England, France, the Balkans, Asia, the Mediterranean and beyond.

WARS AND BATTLES OF THE ROMAN REPUBLIC



Before the days of Pax Romana, the Roman Republic was in an almost constant state of warfare. As it expanded its territory, many a battle was fought on land and at sea against the likes of the Gauls, the Etruscans and the Carthaginians. Chrystal takes on the task of describing and explaining 100 key battles from the struggle to dominate Italy in 753 BCE to the days of Julius Caesar in 100 BCE.

ZEMKE'S WOLFPACK

At a time when the USA had no real air force to speak of, the American 56th Fighter Group, as part of the RAF, were a fighter unit to be feared by the Germans. With a foreword by the son of the eponymous Colonel Zemke himself, this work charts the day-to-day of the 56th in more than 400 captioned photographs drawn from archives and rare personal collections. The photographs are as fascinating as the stories of the ground crew, trainers and pilots are unique.

TANK 100 YEARS OF THE WORLD'S MOST IMPORTANT ARMOURED MILITARY VEHICLE

Writer: Michael E Haskew **Publisher:** Zenith Press **Price:** £25 **Released:** Out now

EVERYTHING YOU EVER WANTED TO KNOW ABOUT TANKS PRESENTED IN A GLOSSY, PHOTO-RICH PACKAGE – IT'S PANZER PARADISE IN BOOK FORM!

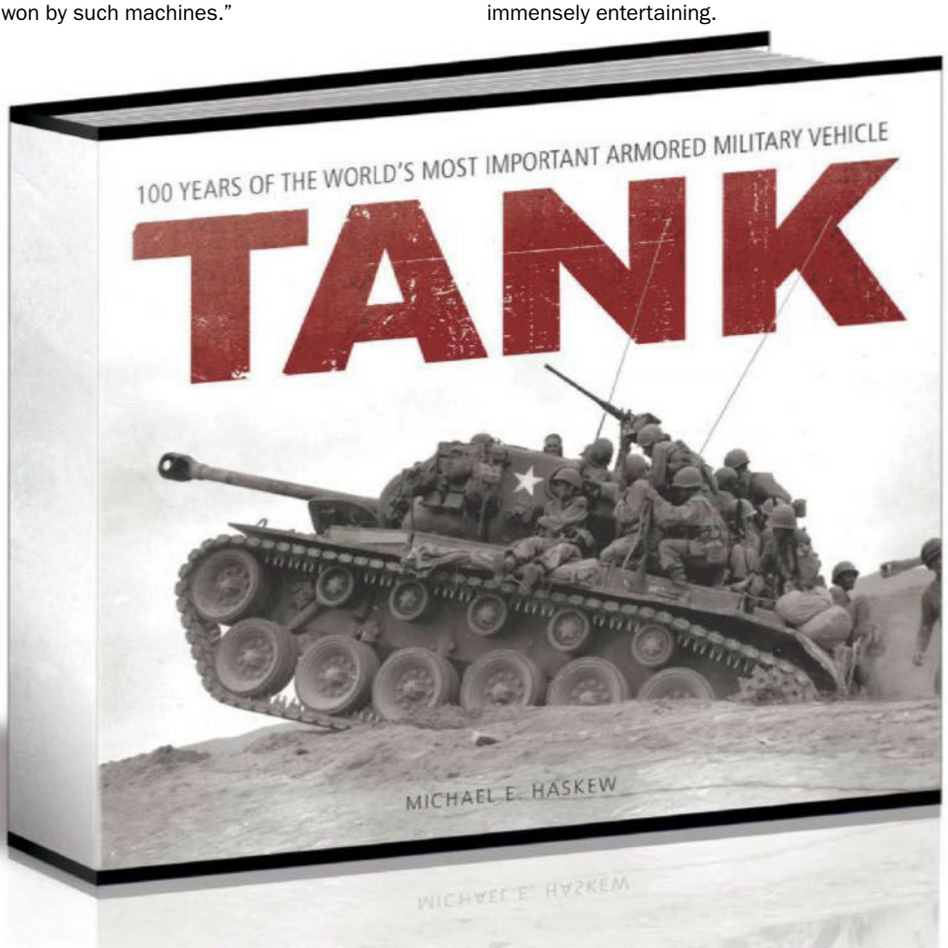
Like most great ideas, the concept of an armoured fighting vehicle has been around for centuries. Leonardo da Vinci is largely credited with coming up with the idea over 500 years ago, on paper at least. While the idea of caterpillar tracks was first dreamt up in the 1770s by a British inventor called Richard Lovell Edgeworth.

It wasn't until halfway through World War I, however, that the technology became available to build an all-terrain vehicle capable of transporting men and weaponry across a battlefield behind the protection of armour plating. Even then, the first designs, created by the British military, were far from perfect. Under orders from Winston Churchill (then first lord of the Admiralty) to create a battleship for the land, or a 'landship', the earliest incarnations of what came to be called tanks were shonky to say the least. Lacking both proper suspension and ventilation, they were dangerous and even potentially lethal to those who operated them. Indeed some remained convinced that these new-fangled tanks were nothing more than a gimmick. After witnessing an early demonstration of the first tank, General Kitchener, then Britain's secretary of state for war and the country's most famous soldier, dismissed what he'd seen as a "mechanical toy", before declaring that "war would never be won by such machines."

Of course, Lord Kitchener was wrong, and Michael E Haskew's coffee table-style book is an encyclopedic history of all things tank, both before and since Kitchener's wildly inaccurate prediction. Via an engaging narrative that's supported throughout with glossy photography and illustrations, we're shown not just how such machines have won wars, but become integral to our culture.

Not surprisingly, we get a comprehensive account of developments in tank technology down the decades. Starting with the early slow-moving behemoths such as the British Mark 1 prototype (based around a tractor, it had a top speed of just two miles an hour) the book takes us right through to the high-speed, high-tech killing machines of the modern battlefield. Along the way, we are expertly guided through its most famous appearances in battle, from its debut on the Somme in 1916 to the role it played in toppling Saddam in the two Gulf Wars, via the monumental clashes at El Alamein and Kursk during World War II.

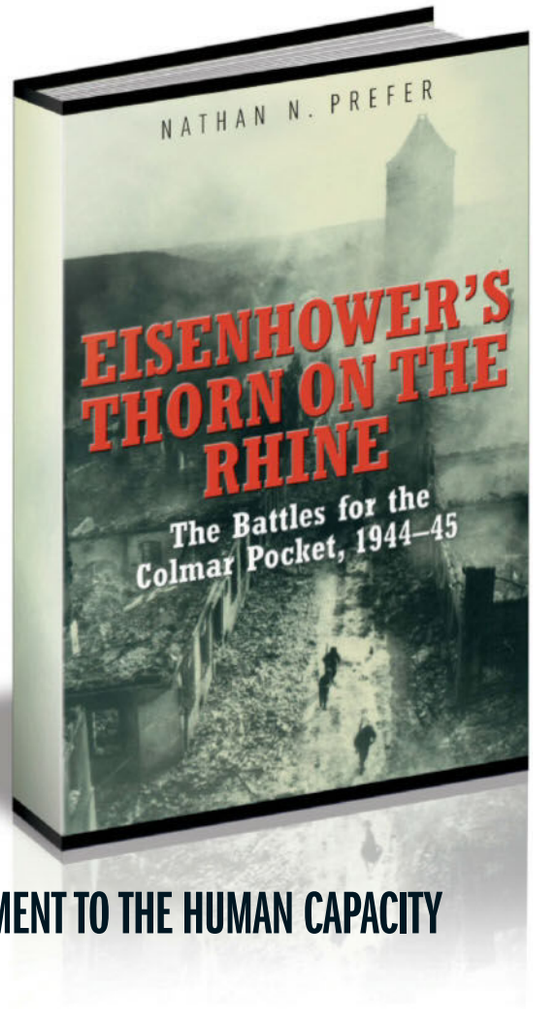
What is less expected is the book's fascinating exploration of other aspects, such as recruitment and propaganda posters, arms manufacturers' advertising spiel, and even the role tanks have played in cinema. As dip-in/dip-out reads go, this is both highly informative and immensely entertaining.



EISENHOWER'S THORN ON THE RHINE

Writer: Nathan N Prefer **Publisher:** Casemate **Price:** £19.99 **Released:** Out now

THE NEGLECTED STORY OF HOW ONE DIE-HARD GERMAN ARMY HELD UP THE ALLIED ADVANCE INTO THE NAZI HEARTLAND FOR WEEKS AFTER THE BATTLE OF THE BULGE

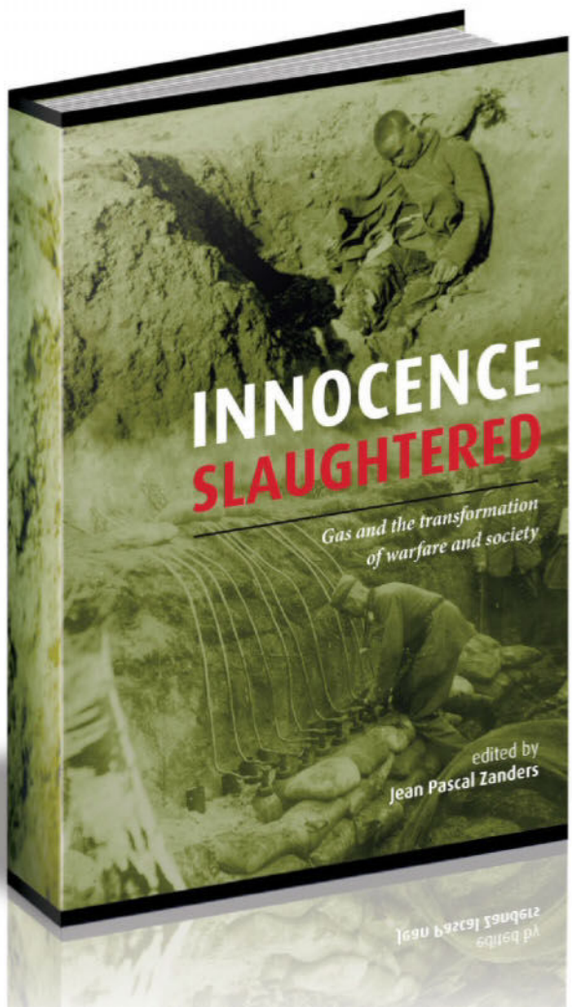


Nathan N Prefer has a reputation for re-examining World War II battles that history, for whatever reason, has overlooked, and in *Eisenhower's Thorn On The Rhine*, he's uncovered a humdinger.

According to the master narrative of history, the end of World War II in Europe goes a little like this: by the winter of 1944, the Western Allies were thundering across France and the Lowlands after the Normandy Invasion that summer, chasing the Nazi hordes back into Germany. Then in December of that year, Hitler launched his counteroffensive in the Ardennes – the famous Battle of the Bulge. Despite heavy casualties, the Americans eventually managed to repel it and by spring 1945, Eisenhower's troops had crossed the Rhine and were closing in on Berlin, while Zhukov's Soviet armies attacked it from the east. Lots of explosions, Hitler shoots himself in a bunker, a few more explosions, the end. It's a tale of epic proportions and it's easy to see how some of the finer detail gets missed along the way, but let's rewind a little.

In the winter of 1944, the Allied Front Line zigzagged its way across Western Europe from the North Sea to Switzerland. The Battle of the Bulge, in fact, came about as a direct result of the jagged nature of the front, even lending its name to that particular action. It was a bitterly fought encounter that's rightly been written about in depth, even becoming – thanks in part to Hollywood – a cornerstone of American military folklore. The large-scale fighting that took place at the same time further south, however, in the Colmar Pocket, has all but been forgotten – long overshadowed perhaps by the headline-grabbing Battle of the Bulge. Until now, thanks to Prefer's highly engaging account of what unfolded.

The Colmar Pocket was named for the pretty Alsatian town at the epicentre of an area of stubborn German resistance that jutted into the south of the Allied line. While the Allies, once they had repelled the Ardennes counteroffensive, made progress along the rest of the front throughout January, German forces clung on in this region of Alsace well into February, ensuring the fighting stayed well west of the Rhine. The resistance presented was deadly, the casualties colossal, and the heroism displayed – on both sides – almost unprecedented. Indeed, the USA's highest military award, the Medal of Honor, was doled out dozens of times during the fighting – most famously to Audie Murphy, who became the country's most decorated combatant of the war and later a Hollywood star himself. All of which makes it even more curious why it has taken so long for a significant study to emerge on what was clearly a highly dramatic and costly encounter.



"THIS IS A MAGNIFICENT TESTAMENT TO THE HUMAN CAPACITY FOR SELF DESTRUCTION"

INNOCENCE SLAUGHTERED

Edited by: Jean Pascal Zanders **Publisher:** Uniform Press
Price: £28 **Released:** Out Now

INSIDE THE BIRTH AND TERRIBLE LEGACY OF CHEMICAL WARFARE

The horror that scientific and military institutions can concoct when united in a common cause is laid bare in this moving collaboration between various historians.

On 22 April 1915, the German Imperial Army unleashed 150 tons of chlorine gas from their trenches on the Ypres Salient, ushering in the start of chemical warfare as the cloud descended upon the unfortunate French soldiers opposing them.

This horrendous event is the main theme of a book that explores subjects ranging from the birth of weaponised chemicals at the hands of Fritz Haber to the German High Command's interpretation of the ethics of war and their subsequent doubts about using gas to break the stalemate on the Western Front.

The outraged reaction to this terrifying development is examined in detail through the eyes of the soldiers and civilians who bore witness to gas attacks and the various newspapers that reported on the "barbarity" of the Germans.

However, despite the vitriol directed at the initial perpetrators, both sides eventually utilised gas in their efforts to secure victory. Photographs and posters of troops from all sides, maimed in various ways by substances such as Mustard gas, emphasise the point forcefully throughout this book.

This is a magnificent testament to the human capacity for self destruction via the means of chemical warfare and the progress of various organisations seeking to end it. It is sobering to think that, despite the success of the Chemical Weapons Convention, gas is still being used in the Syrian Civil War.

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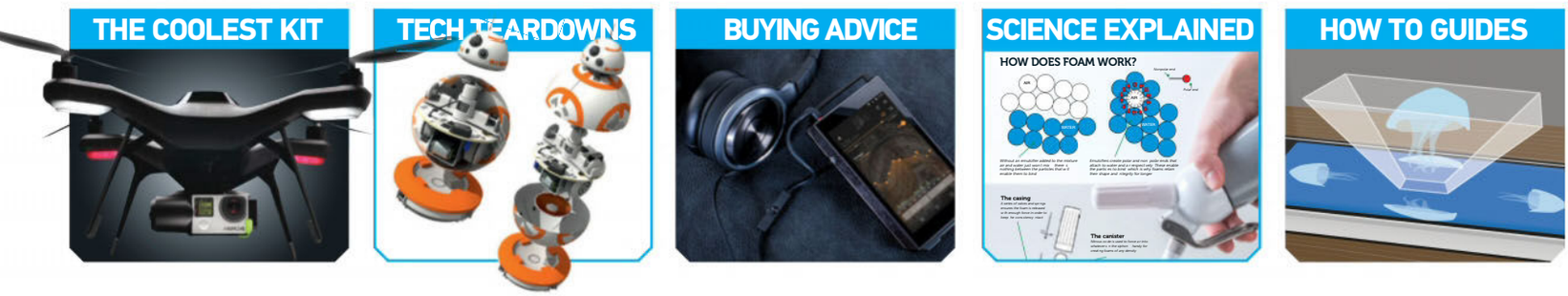

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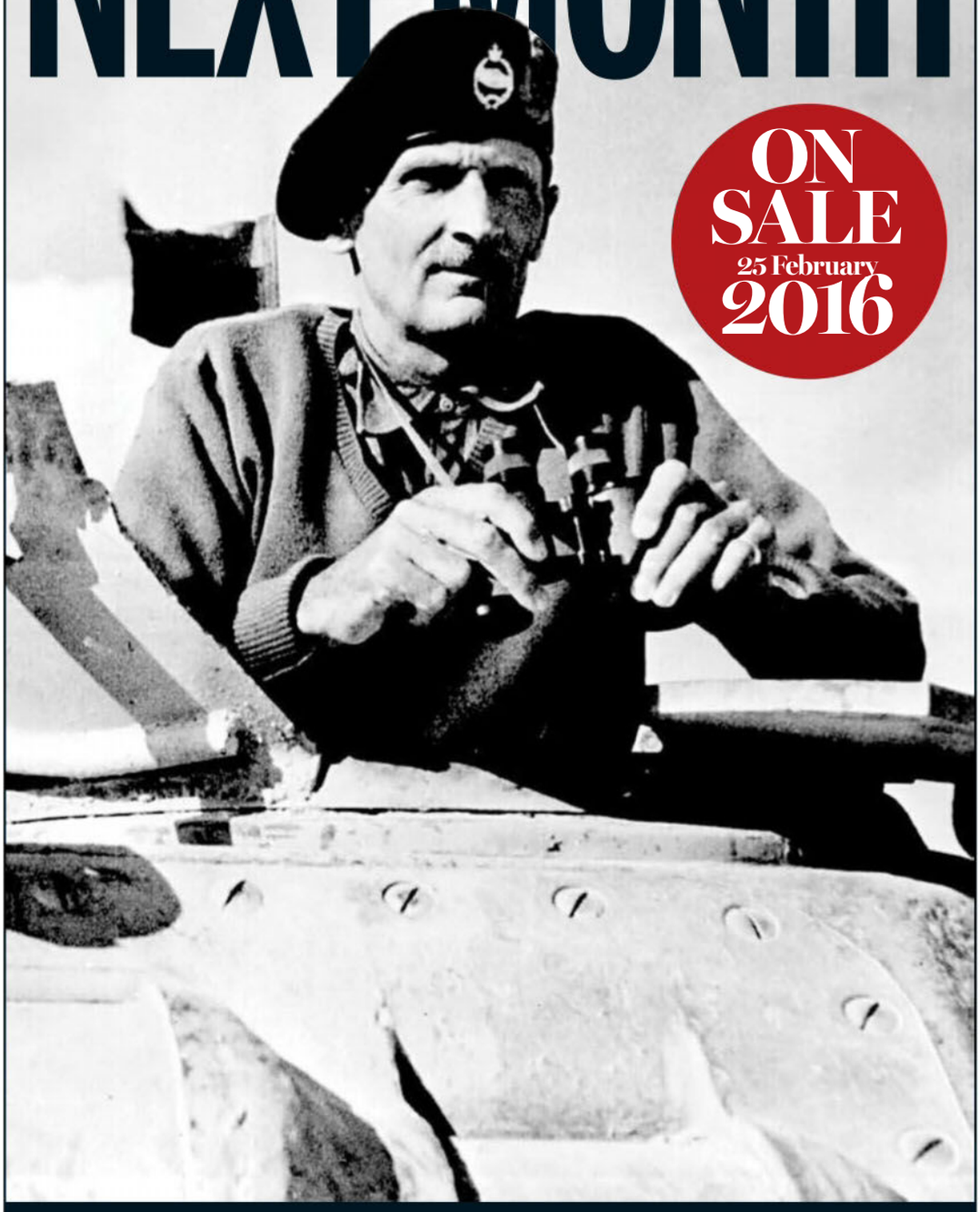

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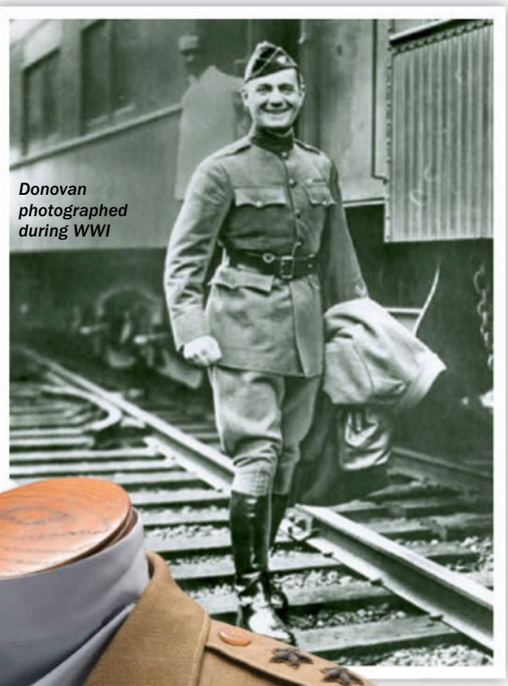
AMERICAN WWI UNIFORM

The ‘Father of American Intelligence’ William Donovan won the Medal of Honor during the Great War, while wearing this jacket

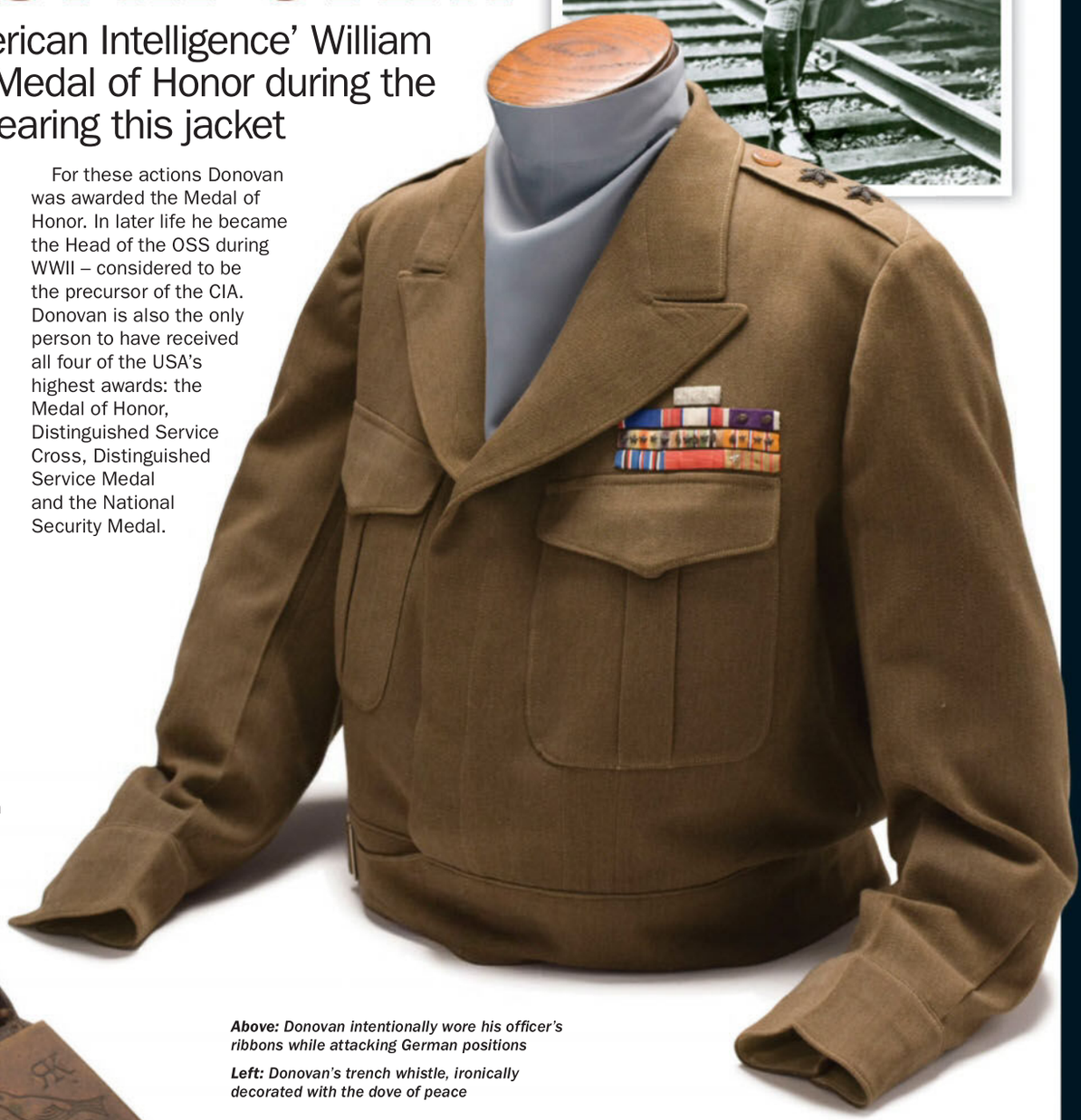
In October 1918, William J Donovan was a lieutenant colonel in the US 165th Regiment of Infantry (known as the ‘Fighting 69th’). While serving in France, his regiment had to contend with seemingly futile orders to capture the high ground of Côte de Chatillon from the Germans. This position was strongly defended by heavy artillery and the enemy was liberally using mustard gas. To get to the position, the Americans had to attack straight over open ground. The reality meant having to cross more than two kilometres of barbed wire, rain, fog and mud.

Donovan’s telephone lines were cut, so he personally crossed the terrain between each unit to keep up communications. He was deliberately dressed in his full officer’s uniform so that he could be easily identifiable to his men. Observers marvelled at this gesture of “gaudy recklessness” and he was recorded as shouting to his troops: “Men, if they can’t hit me, they can’t hit you!” However, Donovan was eventually shot in the right knee. Despite this, he refused to leave the battlefield for four hours until he was certain the position was secured.

For these actions Donovan was awarded the Medal of Honor. In later life he became the Head of the OSS during WWII – considered to be the precursor of the CIA. Donovan is also the only person to have received all four of the USA’s highest awards: the Medal of Honor, Distinguished Service Cross, Distinguished Service Medal and the National Security Medal.



Donovan photographed during WWI



***Above:** Donovan intentionally wore his officer’s ribbons while attacking German positions*

***Left:** Donovan’s trench whistle, ironically decorated with the dove of peace*

“Men, if they can’t hit me, they can’t hit you!” – William J Donovan

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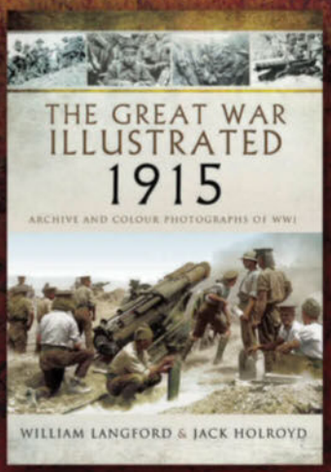

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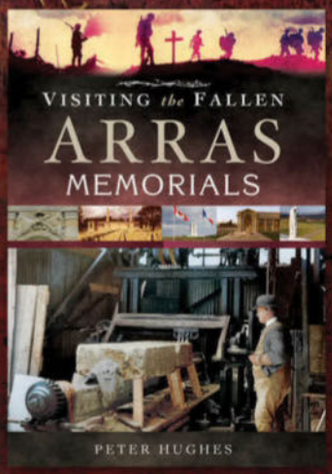

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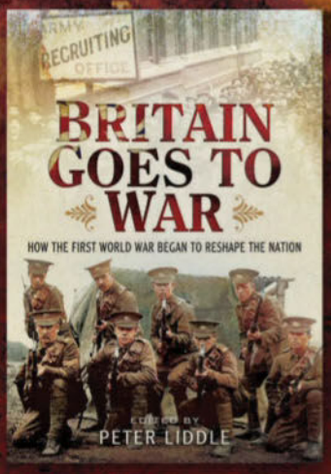

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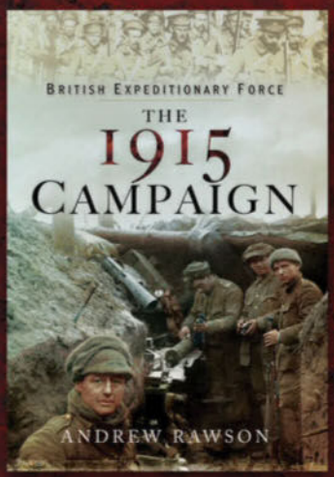

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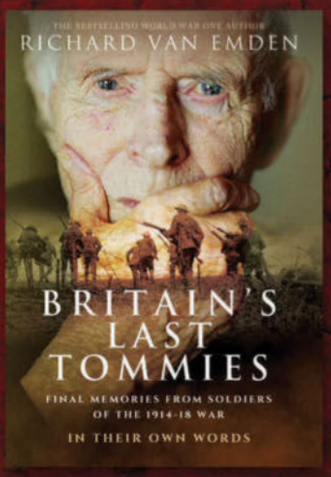

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The Desert Rats' Cromwell

A vehicle made famous by the British 7th Armoured Division, who had been dubbed the Desert Rats for their exploits in North Africa. However, the 7th Armoured were not issued with Cromwells until 1944, when they returned to the U.K. to prepare for D-Day. They fought in their Cromwells across France and into Germany, and eventually took part in the Victory Parade on September 7, 1945, in Berlin.

Development for the Cromwell first began in 1940 when the General Staff knew the Crusader would soon become obsolete. The tank was the fastest British tank to serve in the war, with a top speed of 40 mph (64 km/h). Its dual purpose 75 mm main gun had HE and armour-piercing capabilities and its armour ranged from 8 mm up to 76 mm overall.

In World of Tanks, you can command the Cromwell from the driver's seat. World of Tanks is an online PC game dedicated to tank warfare in the mid-20th century, with over 300 of history's most iconic tanks.
A variety of tiers, upgrades, equipment, and decals allow you to make each tank, your progression and your gameplay experience unique.

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